The association of low and high BMI plus smoking on all-cause and cause-specific mortality in the NHANES III study

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Declaration of the Journal

The main part of this master-thesis is written and formatted according to the author's guidelines for publications in the American Journal of Public Health

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Title: The association of low and high BMI plus smoking on all-cause and cause-specific mortality in the NHANES III study

Running Title: The combination of underweight or obesity with current smoking is related to an especially high mortality risk of all causes, CVD and cancer

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Abstract

Background

Obesity, underweight and smoking are associated with an increased risk of death. We investigated the joint effects of body mass index and smoking on all-cause and cause-specific mortality.

Methods

Data of the National Health and Nutrition Examination Survey (1988-1994) including mortality follow-up until 2011, were used. Cox proportional hazard models were used to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for all-cause, cardiovascular disease (CVD) and cancer mortality with BMI, smoking and their combinations as exposure.

Results

Obese and underweight current smokers were the two combinations with the highest risks of death from all-causes, CVD, and cancer. Among underweight participants current smokers, the hazard ratio of death from all causes was 3.49 (95% CI, 2.42-5.02) and for obese current smokers 2.76 (2.12-3.58). CVD mortality risk was the highest among obese current smokers, for cancer mortality among underweight current smokers.

Conclusion

Being underweight or obese and smoker at the same time is associated with an especially high risk of death. Smokers with high or low BMI should be particularly targeted for smoking cessation programs.

Abbrevations

BMI:	body mass index
CDC:	Centres for Disease Control and Prevention
CI:	confidence interval
CVD:	cardiovascular disease
ICD:	International Classification of diseases
HR:	hazard ratio
NCHS:	National Centre for Health Statistics
NHANES III:	the Third National Health and Nutrition Examination
NDI:	National Death Index
WHO:	World Health Organisation
SD:	standard deviation
SES:	socio-economic status

1. Introduction

Obesity and smoking are common and preventable causes of disease and mortality. They have both been linked to increased risk of mortality, in large part due to the cancers and cardiovascular diseases (CVD).[1] Romero-Correl et al.,[2] observed in their meta-analysis that mortality risk, after adjustments for age, sex, smoking and hypertension, increased when the BMI was above 25 kg/m^2, and if the BMI was below 20 kg/m^2. The association between BMI and mortality was, however, not entirely clear. The association is described as being either linear, U-shaped or J-shaped.[3,4]

Smoking is related to a high risk of all-cause and cause-specific mortality, such as cancer and cardiovascular diseases.[5] Rate of death among current smokers is about three times higher compared to people who have never smoked.[6] A recent study, based on population-based health surveys in Switzerland, found a strong association between heavy smoking and cancer mortality.[7]

Whereas smoking is a strong risk factor, some issues have arisen regarding the effects of the joint association between body weight and smoking. Some studies examined the mortality associated with BMI and smoking combined and observed a strong correlation.[1,3,8,9] Current smokers that were obese had a much higher mortality risk than never smokers who were normal weight. The risk of CVD mortality increased especially. Underweight current smokers also had a higher chance of premature death, for both cancer and CVD.[1,8] Others studies showed inconsistent results with respect to the relationship between smoking and BMI on mortality.[9-11] In these studies, a significantly increased mortality among light and heavy smokers who were underweight or overweight was not seen. Only among heavy smokers who were obese was an increased mortality risk observed. Studies that excluded smokers from their study population found a linear association between elevated BMI and mortality, suggesting that the increased risk of mortality among underweight people was due to smoking.[4,12]

To date, studies looking at the joint association between BMI and smoking on mortality are rare and their results are inconsistent. Therefore, the aim of this present study was to assess the association between different BMI categories, smoking status, and their combinations with the risk of all-cause and cause-specific mortality of cancer and cardiovascular disease in National Health and Nutrition Examination Survey (NHANES III) participants.

2. Materials and Methods

2.1 Data Collection and Study Population

Our analyses were based on data of the Third National Health and Nutrition Examination Survey (NHANES III). The NHANES III is a cross-sectional population-based study conducted by the National Centre for Health Statistics (NCHS), which is part of the Centres for Disease Control and Prevention (CDC). Participants are selected through a stratified multistage probability sample of 33,994 non-institutionalised persons. Data was collected in two phases (1988–1991 and 1991-1994). The aim of NHANES III was to gather information on the health and nutritional status of the population of the United States. Details on data collection of the NHANES III are published elsewhere.[13]

For this study, data from the NHANES III Household Exam File were analysed. These data were linked to the National Death Index (NDI) mortality file with follow-up until December 2011. The study population compromised 17,483 participants with a mean and maximum follow up time of 16.6 years and 23.0 years, respectively. Exclusion criteria were missing data on mortality (n=14), BMI and smoking (n=50) and other covariates (n=205).

Mortality

Ascertainment of end points was determined from the NHANES III prospective cohort mortality study. From the time of study enrolment (1988-1994) through to December 31, 2011, participants were followed and their vital status determined. All-cause mortality, cancer mortality and cardiovascular disease (CVD) mortality were used for this analysis. Deaths were classified by International Classification of diseases (Cancer: ICD-9 140–208, ICD-10 C00-C97; CVD: ICD-9 390–434, and 436–448, ICD-10 100-178).

Body mass index and smoking

Body mass index (BMI) was based on height and weight as the ratio of weight in kilograms and height in meters squared (kg/m^2). Underweight was defined as BMI $<$ 18.5, normal weight as BMI $\geq$ 18.5 and $<$ 25, overweight as BMI $\geq$ 25 and $<$ 30, and obese as BMI $\geq$ 30. These categories correspond to those defined by the World Health Organization (WHO).

Information on cigarette smoking was based on self-reporting. The survey asked: Have you ever smoked 100 cigarettes or more in your life? Do you still smoke? If participants answered yes to both questions, they were defined as current smoker for the purpose of this study. If their answer was yes to the first and no to the second question they were defined as a former smoker. If they answered no to both questions, they were defined as never smoker. Normal weight and never smoker as well as its combination were used as reference groups.

Covariates

Demographic variables were included as adjustment variables based on known or suspected confounders. The following covariates were included: age, used as a continuous and categorical variable with the three categories of 18 to 39 years (category 1), 40 to 59 years (category 2), 60 to 90 years (category 3); sex: male, female; race/ethnicity: non-Hispanic whites, non-Hispanic blacks, Mexican-Americans, and others. As a proxy of socio-economic status, educational level was used and classified as less than high school diploma, high school diploma, more than high school diploma. Alcohol consumption was defined as: never to < 1drink/week; ≥ 1drink/week to < 1drink/day; ≥ 1drink/day. Marital status was defined as: married/living together, separated/widowed, and never married. Leisure-time physical activity were categorised as: inactive (0-1 activity/week), infrequently active (1-< 5 activities/week), and active (≥ 5 activities/week).

2.2 Statistical analysis

Because participants did not have an equal probability of selection, and there was the chance of oversampling as well as non-response, sample weights were used to obtain estimates representative for the population. Sample weights were implemented through the survey function in STATA.

Descriptive analyses were conducted to estimate counts, means and proportions of the participants' characteristics. Death rates for all-cause mortality and cancer- and CVD-specific mortality were calculated by dividing the number of deaths by the total number of person-years during the follow up period. Cox proportional hazard models were conducted to estimate hazard ratios (HRs) and their corresponding 95% confidence intervals (CIs). The mortality risk of all-cause mortality, cancer and CVD mortality was compared for subjects of different categories, and

combinations of BMI and smoking status measured at the baseline. Hazard ratios were measured for the total sample, men and women separately, and different age categories. Depending on the investigated model, the reference group was composed of participants with normal weight (BMI ≥ 18.5 and < 25 kg/m2), being never smokers, and being normal weight never smokers. Age, sex, education, marital status, race, leisure activity level, and alcohol consumption were fitted in the cox models. Sensitivity analyses were performed to assess whether the association between BMI, smoking, their combinations, and the risk of death varied according to the presence or absence of prevalent diseases (cancer, heart failure, heart attack), smoking intensity (light/moderate/heavy), waist to hip ratio and waist circumference. Finally, a Wald test was performed to determine the interaction between BMI and smoking on mortality risk.

All analyses were carried out using Stata™ (Stata Statistical Software: Release 13.1. College Station, TX: StataCorp LP).

3. Results

3.1. Patient characteristics

The study population (n=17,483) consisted of 8,150 men and 9,333 women. During follow-up a total of 5,351 deaths occurred, of which 1,150 were caused by cancer and 1,318 by CVD.

Baseline characteristics of the study population are shown in Table 1. The majority of participants were between 18 and 39 yrs old (category 1). The majority of women had a normal weight and were never smokers. Most men indicated normal weight or overweight and smoking status was equally distributed over all three categories. Most participants were non-Hispanic white. The non-Hispanic black and Mexican-American participants were distributed evenly. In general, most participants were married or living with a partner and had a high school education.

3.2 BMI and Smoking on all-cause mortality

Table 2 shows the HR with a 95% confidence interval for BMI and smoking, including their combinations, on all-cause mortality, CVD-mortality, and cancer mortality for the fully adjusted model (both sexes combined and separated). Underweight and obese participants who were current smokers had an increased risk of all-cause mortality (HR = 3.49 [95% CI 2.42-5.02] and 2.76 [2.12-3.58], respectively). If the participants were underweight and never smoked, they still

had an increased mortality risk (1.65 [1.15-2.37]) compared to normal weight never smokers. For never smoking obese participants the risk of mortality compared to normal weight never smokers was not significantly elevated. However, despite these differences, there was no statistically significant interaction between BMI and smoking with regard to all-cause mortality in the whole study population (P =0.49).

Stratified analyses showed that if BMI and smoking status were combined, underweighted men only had a significantly higher mortality risk when they were current smokers (2.71 [1.72-4.27]). Underweighted women had a significantly higher risk in all smoking status categories. The association between overweight and mortality rate of non-smoking men was inverse compared to normal weight men who never smoked (0.66 [0.52-0.86]). The mortality risk increased significantly for overweight or obese men who were current smokers. Obese women had a higher risk of mortality in all smoking status categories.

Table 3 refers to the all-cause mortality risk of BMI and smoking, stratified by age group. Due to a small number of deaths in the specific age groups, it was not possible to calculate results for CVD mortality risk and cancer mortality risk. Of the 5,351 participants who died during follow-up, 4,022 were between 60 and 90 years old. In this age group, the all-cause mortality risk was the highest when the participants were underweight and current smokers (3.58 [2.52-5.09]). The highest risk of mortality among the participants between 40 and 59 years old was among participants with underweight or obesity and who were current smokers. Among participants between 18 and 39 years old, obese participants in all smoking categories had a significantly higher all-cause mortality risk. No interaction between BMI and smoking on mortality was observed in any age group.

3.3 BMI and smoking on mortality of cardiovascular disease and cancer

Obesity and smoking were independent risk factors for dying from CVD and cancer. Obesity combined with current smoking was the most important risk factor linked to CVD mortality (3.33 [2.08-5.33]), and underweight combined with current smoking was the most important factor linked to cancer mortality (5.28 [2.68-10-38]). There was, however, no statistically increased risk in CVD mortality in any smoking status category for underweight participants overall. All BMI categories combined with current or former smokers were associated with an elevated risk of dying from cancer. No interaction between BMI and smoking on CVD and cancer mortality was

observed (Table 2).

3.4 Sensitivity analyses

We performed sensitivity analyses with the exclusion of participants with cancer, heart failure and heart attack at baseline, for all performed analyses (results not shown). A major change in the results was not observed. Only, when we excluded prevalent diseases, we found a statistically significant interaction between smoking and BMI on CVD mortality (P = 0.031). Other sensitivity analyses with inclusion of smoking intensity, waist to hip ratio, and waist circumference led to similar results.

4. Discussion

4.1. Main results

In this large population-based study the joint relations of BMI and smoking status on mortality were examined. The coexistence of obesity or underweight with current smoking was associated with a higher risk of mortality compared to normal weight never smokers. In line with other studies, an increased mortality risk was found at both extremes of the BMI range, suggesting a U- or J- shaped association.[4,14] However, we did not find any statistically significant interaction effect between smoking and BMI on all-cause mortality, CVD mortality or cancer mortality. We only found a statistically significant interaction effect between smoking and BMI on CVD mortality if we excluded prevalent diseases from our analyses.

4.2 BMI and smoking on mortality

Consistent with our findings, both smoking and obesity are independent risk factors for premature death, and the combination of obesity and smoking results in an exponentially increased mortality risk.[15,16] We observed this in all age categories. A possible explanation for this association between smoking and obesity on mortality could be that smokers are more likely to have unhealthy lifestyle habits. They tend to have low leisure time physical activity and a lower consumption of fruit and vegetables.[17] These unhealthy behaviours favour weight gain. Obese heavy smokers in particular tend to have a poor general lifestyle.[18] Smoking and obesity are both associated with insulin resistance, higher blood pressure and an increased level of stress hormones.[19] This may result in higher risk of CVD and various types of cancer (9). Several

studies have reported obesity as a risk factor for various cancers.[20-22] This may be due to insulin resistance and a chronic, subclinical inflammation in the visceral fat.[22,23] As our study showed, the mortality risk of cancer is especially elevated in obesity when it occurs combined with current smoking.

As reflected in our results, the relationship between underweight and a higher mortality risk is mostly explained by the confounding effect of smoking.[12,24] In this study we found a significantly higher risk of mortality for current smokers and former smokers with underweight. Smokers tend to be leaner compared to never smokers. On average, male smokers tend to be 1 BMI unit and female smokers 1.5 BMI units lighter than nonsmokers.[12] Smoking is a risk factor for respiratory disease, smoking-related cancers and impaired kidney function.[21,25] We also found a moderately increased all cause-mortality risk in participants with underweight who never smoked. Other studies also showed that after excluding smoking from the analysis, underweight participants still had an increased risk of all-cause mortality.[3,10,24,26] An explanation for these findings may be pre-existing diseases at baseline. When studies excluded underweight participants with underlying diseases, current smokers and those who died within the first 5 years of follow-up found no significant associations between underweight and all-cause mortality.[24,27] In our study we found an elevated risk of all-cause mortality for participants in the older age group (60 to 90 yrs old) with underweight who never smoked. Older participants are more likely to carry chronic diseases and co-morbidities, leading to low BMI, which may have biased the results.

We found a significantly increased risk of all-cause mortality if smoking and obesity or smoking and underweight were combined, although a statistically significant interaction effect between smoking and BMI on mortality was not observed in this study. Several other studies have also been unable to see an interaction effect.[9,28,29] It is possible that smoking potentiate the effects of cardiovascular risk factors, like dyslipidemia, hypertension or insulin resistance.[20] This could explain the interaction effect we found between smoking and BMI on CVD mortality in the sensitivity analyses.

4.3 Strengths and Limitations

NHANES III is a large, representative, well-standardized and controlled survey that follows up to 23 years on vital status. Results can be generalized to the US population. Though the sample size was large, there was high variability. Due to the small sample size of the underweight

participants, and particularly former smokers with underweight, the estimates were imprecise. In this study different known confounders were included. Mortality risks in never smokers with obesity and underweight might be explained by socio-economic status (SES). A higher SES may have a positive impact on diet, exercise and coping with daily stressors, which can prolong life.[30-32] We are confident that we have taken the most important confounders into account. Nevertheless, confounding due to unknown or unmeasured factors cannot be excluded. For example, we only included the absence of cancer, heart attack and heart failure into the sensitivity analyses, other pre-existing diseases at baseline could have biased the results, especially in participants with underweight. On the other hand, it is not known if these diseases induced weight loss before baseline and weather such weight loss biased the results. Dividing smokers into light, moderate and heavy categories in the sensitivity analyses gave us in depth information about the dose response effect of smoking on mortality in the different BMI categories. Heavy smoking is associated with bad lifestyle habits and can lead to a lower BMI or higher BMI.[19,33] Some studies showed an increased body weight to obesity level among heavy smokers.[34,35] Although the results did not change when we included smoking intensity into the analyses, misclassification could have occurred. Information about smoking intensity in the NHANES-III data was based on self-reporting, and people mostly underreport their smoking habits, which could have lead to an over- or underestimation in the results.

A strength of this study was that information about BMI was based on height and weight measured in a standardized way. Thereby, measurement bias and misclassification of subjects in the wrong BMI category was minimized. Still, most of the information in this study, like smoking status, was given by self-reporting, which induced measurement and recall error. In general, there is a growing debate about possible needs for different BMI cut-off points. The BMI categories are defined independently of age, gender, and ethnicity. There is growing evidence that due to different body proportions, BMI may not correspond to the same percentage of body fat and body fat distributions in all ethnic groups.[36,37] Some degree of misclassification in this study is therefore inevitable. Although BMI is correlated with more direct measurements of body fat, it does not directly measure adiposity or lean body mass. Elderly people tend to have an increase in waist to hip ratio, because body fat shifts from peripheral to central sites without an increase in BMI.[37,38] Therefore, we took waist to hip ratio and waist circumference into account in the sensitivity analyses. Finally, there is no information about changes over time as measurements

were taken at baseline. Changes in weight and smoking during follow up may have had an impact on the mortality risk. There was no data available on the duration of quitting for former smokers at baseline and no data on current smokers who had quit during the follow up period. Thus we could not demonstrate the effects of the duration of quitting and compare smokers who quit with those who did not during follow up. Also, in these data, we had no information about passive smoking. This could have led to over- or underestimation of the risk of mortality.

5. Conclusion

Regardless of smoking status we found an increased mortality risk among participants with underweight or obesity. Also, former and current smokers were an independent predictor of mortality. The combination of underweight and obesity with current and former smoking was related to an especially high mortality risk of all causes, CVD and cancer. Therefore, smokers with high or low BMI should be particularly targeted for smoking cessation programs. The evidence that being underweight per se causes higher mortality risk is still weak. There is a need to find the underlying factors behind the higher risk of mortality for people who are underweight.

Disclosures

The authors have no conflicts of interest to disclose. No financial interest are involved.

Author Contribution

EL collected, analysed, and interpreted study data. EL wrote the first draft of the manuscript. SR, TL and DF critically revised and improved the content of the manuscript. All authors read and improved the final manuscript.

Human Participant Protection Statement

We used publically available data that have been anonymized by NHANES.

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Tables

Table 1 Baseline characteristics weighted sample (% unless otherwise indicated) of participants of NHANES III (1988-1994), categorized by body mass index and smoking status

	BMI (kg/m$^{2)}$				Smoking status		
	<18.5	≥ 18.5-<25	≥ 25-<30	≥ 30	never	former	current
	2.9	43.9	31.8	21.4	46.6	25.1	28.3
Sex: mean age (SD)							
Male :47.2 (0.3)	1.3	41.2	38.7	18.8	37.3	30.9	31.8
Female: 44 (0.2)	4.3	46.4	25.5	23.8	55.2	19.7	25.1
Age-catgories							
18-39	3.8	52.3	27.0	16.9	51.6	14.2	34.2
40-59	1.8	36.2	34.4	27.6	39.7	31.6	28.7
60-90	2.3	36.1	38.7	22.9	45.2	40.0	14.8
Smoking status: Men							
never	0.5	15.9	14.4	6.5	-	-	-
former	0.2	9.7	13.2	7.8	-	-	-
current	0.6	15.6	11.1	5.0	-	-	-
Smoking status: Women							
never	2.4	25.0	14.7	13.1	-	-	-
former	0.4	8.8	5.4	5.1	-	-	-
current	1.6	12.6	5.4	5.5	-	-	-
Ethnicity							
non-Hispanic white	2.8	44.9	31.8	20.5	43.5	27.8	28.7
non-Hispanic black	2.7	37.8	31.6	27.9	52.3	15.3	32.4
Mexican-american	1.5	36.3	37.2	25.0	58.0	19.6	22.4
others	4.2	48.6	28.6	18.6	62.3	16.0	21.7
marital status							
Married	2.0	41.0	34.4	22.6	43.2	28.8	28.0
divorced/widowed	2.9	42.0	30.0	25.1	43.2	26.3	30.5
never married	6.0	55.7	24.4	13.9	61.4	11.4	27.2
Leisure time activity							
Inactive	2.8	38.7	32.6	25.9	45.3	25.2	29.5
infrequently active	2.7	46.3	32.4	18.6	45.5	24.1	30.4
Active	3.3	51.9	29.4	15.4	50.9	25.9	23.2
alcohol intake							
Never	3.2	39.2	31.5	26.1	54.1	24.1	21.8
≤ 1 drink/week	2.5	45.3	31.0	21.2	46.8	24.1	29.1
1 drink /week to < 1 drink/day	2.5	50.5	32.2	14.8	38.5	24.0	37.5
≥ 1drink/day	3.4	47.6	35.4	13.6	25.2	38.0	36.8
Education							

< high school	1.4	36.3	37.0	25.3	54.2	23.7	22.1
high school	2.7	41.2	32.0	24.1	40.4	23.7	35.9
>high school	3.3	48.6	30.9	17.2	54.0	27.0	19.0

Notes
Abbrivations: NHANES, National Health and Nutrition Examination Survey; SD, standard deviation; BMI, body mass index

Table 2.
Hazard ratios (HR) of death from all causes, CVD, and Cancer, according to BMI and smoking on the weighted sample NHANES III[a]

	total			men			women		
	All causes deaths=5351	CVD Deaths=1318	Cancer Deaths=1150	All causes Deaths=2825	CVD Deaths=734	Cancer Deaths=645	All causes Deaths=2526	CVD Deaths=584	cancer Deaths=505
	HR (95%CI)	HR (95%CI)	HR (95%CI)	HR (95%CI)	HR (95%CI)	HR (95%CI)	HR (95%CI)	HR (95%CI)	HR (95%CI)
Underweight[c]	1.67 (1.30-2.16)	1.27 (0.67-2.39)	1.55 (0.88-2.75)	1.51 (1.06-2.17)	1.00 (0.55-1.82)	1.46 (0.70-3.07)	1.78 (1.29-2.46)	1.42 (0.60-3.35)	1.52 (0.73-3.18)
Normal weight[c]	1 (referent)	1(referent)	1(referent)	1(referent)	1(referent)	1(referent)	1(referent)	1(referent)	1(referent)
Overweight[c]	0.92 (0.84-1.01)	0.97 (0.80-1.16)	0.92 (0.75-1.13)	0.81 (0.71-0.91)	0.93 (0.72-1.19)	0.78 (0.59-1.01)	1.07 (0.94-1.22)	0.98 (0.75-1.29)	1.17 (0.85-1.61)
Obese[c]	1.20 (1.08-1.34)	1.37 (1.11-1.71)	1.32 (1.05-1.65)	1.10 (0.93-1.3)	1.31 (0.96-1.80)	1.12 (0.80-1.55)	1.33 (1.14-1.54)	1.45 (1.07-1.95)	1.59 (1.16-2.17)
Never smoker	1 (referent)	1(referent)	1(referent)	1(referent)	1(referent)	1(referent)	1(referent)	1(referent)	1(referent)
Former smoker	1.33 (1.21-1.45)	1.25 (1.04-1.49)	1.82 (1.46-2.28)	1.30 (1.1-1.5)	1.35 (1.04-1.74)	1.57 (1.15-2.16)	1.36 (1.99-1.55)	1.15 (0.87-1.52)	1.77 (1.29-2.44)
Current smoker	2.17 (1.92-2.46)	2.14 (1.69-2.71)	3.30 (2.60-4.20)	1.90 (1.6-2.3)	2.06 (1.49-2.86)	2.80 (1.9-4.05)	2.33 (1.96-2.77)	2.33 (1.67-3.27)	3.41 (2.50-4.64)
P Interaction[b]	0.49	0.06	0.58	0.12	0.06	0.37	0.78	0.35	0.81
Underweight									
Never smoker	1.65 (1.15-2.37)	1.69 (0.74-3.88)	0.67 (0.26-1.76)	2.31 (0.96-5.59)	0.58 (0.12-2.90)	0.79 (0.15-4.00)	1.59 (1.06-2.34)	1.90 (0.76-4.77)	0.67 (0.20-1.86)
Former smoker	2.39 (1.10-5.16)	1.38 (0.68-2.80)	6.04 (1.54-23.73)	1.10 (0.59-2.04)	2.35 (1.16-4.78)	0.79 (0.15-4.00)	3.67 (1.14-11.82)	undetermined	9.94 (2.35-42.1)

Current smoker	3.49 (2.42-5.02)	2.01 (0.59-6.81)	5.28 (2.68-10.38)	2.71 (1.72-4.27)	1.07 (0.27-4.28)	6.05 (2.34-15.7)	3.88 (2.47-6.09)	2.82 (0.63-12.58)	4.29 (1.74-10.5)
Normal weight									
Never smoker	1 (referent)	1 (referent)	1(referent)	1(referent)	1(referent)	1(referent)	1(referent)	1 (referent)	1(referent)
Fomer smoker	1.35 (1.15-1.58)	1.28 (0.96-1.72)	2.03 (1.38-3.00)	1.13 (0.89-1.43)	1.31 (0.82-2.05)	1.53 (0.85-2.76)	1.36 (1.1-1.7)	1.23 (0.79-1.90)	2.04 (1.17-3.56)
Current smoker	2.06 (1.74-2.44)	1.61 (1.12-2.34)	3.50 (2.46-5.00)	1.65 (1.28-2.14)	1.56 (0.92-2.63)	3.07 (1.72-5.49)	2.20 (1.74-2.77)	1.65 (0.91-2.99)	3.08 (1.92-4.94)
Overweight									
Never smoker	0.90 (0.78-1.04)	0.87 (0.66-1.15)	0.99 (0.70-1.43)	0.66 (0.52-0.86)	0.91 (0.56-1.47)	0.78 (0.42-1.42)	1.03 (0.87-1.22)	0.83 (0.59-1.16)	1.15 (0.73-1.8)
Former smoker	1.22 (1.05-1.42)	1.10 (0.82-1.45)	1.80 (1.27-2.55)	0.94 (0.75-1.17)	1.05 (0.69-1.61)	1.32 (0.77-2.72)	1.51 (1.22-1.87)	1.16 (0.72-1.88)	1.94 (1.14-3.39)
Current smoker	2.01 (1.66-2.43)	2.21 (1.53-3.18)	3.15 (2.10-4.74)	1.48 (1.11-1.93)	1.85 (1.09-3.13)	2.12 (1.10-4.07)	2.5 (1.89-3.30)	2.84 (1.67-4.83)	4.38 (2.6-7.41)
Obese									
Never smoker	1.19 (1.02-1.39)	1.22 (0-90-1.66)	1.52 (1.03-2.24)	0.93 (0.68-1.27)	0.88 (0.47-1.64)	1.27 (0.58-2.79)	1.34 (1.12-1.61)	1.42 (0.10-2.02)	1.71 (1.10-2.66)
Former smoker	1.51 (1.28-1.78)	1.53 (1.11-2.13)	2.33 (1.59-3.40)	1.22 (0.95-1.58)	1.62 (1.01-2.61)	1.84 (1.01-3.35)	1.62 (1.29-2.04)	1.37 (0.84-2.24)	2.32 (1.36-3.94)
Current smoker	2.76 (2.12-3.58)	3.33 (2.08-5.33)	4.80 (3.08-7.48)	2.05 (1.43-2.93)	3.12 (1.63-5.96)	2.90 (1.36-6.17)	3.27 (2.23-4.80)	3.59 (1.83-7.05)	5.95 (3.49-10.1)

notes

Abbreviations: NHANES, National Health and Nutrition Examination Survey; CVD, cardiovascular disease; BMI, body-mass index; HR, hazard ratio; CI, confidence interval

[a] adjusted for age, gender, alcohol, race,marital status, education, activity

[b] P for interaction between BMI, smoking and mortality was performed by Wald test

[c] Underweight (BMI: <18.5 kg/m^2); normal-weight (BMI: ≥18.5– <25 kg/m^2); overweight (BMI: ≥ 25.0– <30 kg/m^2); obese (BMI: ≥ 30kg/m^2)

Table 3
Hazard ratios (HR) of death from all causes, according to BMI and smoking on the weighted sample NHANES III[a], stratified by age categories:

	18-39	40-59	60-90
	All causes deaths=394	All causes deaths=935	All causes deaths=4022
	HR (95%CI)	HR (95%CI)	HR (95%CI)
Underweight[b]	1.16 (0 .47- 2.85)	1.79 (0.96 -3.33)	2.05 (1.36-3.10)
Normalweight[b]	1 (referent)	1 (referent)	1 (referent)
Overweight[b]	1.05 (0.70- 1.56)	0.95 (0.74-1.23)	0.86 (0.77- 0.96)
Obese[b]	1.87 (1.24- 2.83)	1.76 (1.38-2.23)	0.83 (0.74- 0.94)
Never smoker	1 (referent)	1 (referent)	1 (referent)
Former smoker	1.17 (0.67-2.05)	1.56 (1.17-2.06)	1.22 (1.09-1.36)
Current smoker	1.63 (1.10- 2.41)	2.76 (2.13-3.58)	1.42 (1.24- 1.62)
P Interaction[c]	0.64	0.68	0.34
Underweight			
Never smoker	1 (0.26-3.78)	1.08 (0.21-5.53)	2.09 (1.33-3.27)
Former smoker	undetermined	6.77 (1.64-27.93)	1.61 (0.41-6.44)
Current smoker	2.04 (0.60-6.94)	4.22 (1.85-9.62)	3.58 (2.52-5.09)
Normal weight			
Never smoker	1 (referent)	1 (referent)	1 (referent)
Former smoker	0.82 (0.34-1.97)	1.51 (0.84-2.72)	1.25 (1.04-1.50)
Current smoker	1.54 (0.87-2.70)	2.68 (1.65-4.36)	1.40 (1.14-1.72)

Overweight			
Never smoker	0.79 (0.40-1.53)	1.04 (0.61-1.80)	0.84 (0.72-0.99)
Former smoker	1.21 (0.51-2.90)	1.32 (0.76-2.30)	1.07 (0.91 -1.26)
Current smoker	1.84 (0.99-3.43)	2.55 (1.51-4.30)	1.28 (1.04-1.59)
Obese			
Never smoker	1.92 (1.01-3.65)	1.59 (0.96-2.64)	0.88 (0.74-1.05)
Former smoker	2.76 (1.04-7.33)	2.74 (1.64-4.55)	1.01 (0.84-1.21)
Current smoker	2.29 (1.20-4.38)	4.84 (2.94-7.97)	1.04 (0.74-1.46)

Notes:

Abbreviations: NHANES, National Health and Nutrition Examination Survey; BMI, body-mass index; HR, hazard ratio; CI, confidence interval

[a] adjusted for age, gender, alcohol, race,marital status, education, activity

[b] Underweight (BMI: <18.5 kg/m^2); normal-weight (BMI: ≥18.5– <25 kg/m^2); overweight (BMI: ≥ 25.0– <30 kg/m^2); obese (BMI: ≥ 30kg/m^2)

[c] P for interaction between BMI, smoking and mortality was performed by Wald test

Appendix

A. Kritische Würdigung -Methodenkritik

In dem folgenden Kapitel werden die einzelnen Aspekte des methodischen Vorgehens einer kritischen Reflexion unterzogen und alternative Vorgehensweisen aufgezeigt.

Reflexion des forschungsmethodischen Vorgehens

Das Ziel dieser Arbeit, den Zusammenhang zwischen BMI und Rauchen in Bezug auf das Mortalitätsrisiko zu erfassen, konnte erreicht werden. Untergewicht und Adipositas, sowie Rauchen und Ex-Rauchen erzeugten ein erhöhtes Mortalitätsrisiko. Sowohl bei Personen mit Untergewicht die rauchen oder geraucht haben, wie auch bei Personen mit Adipositas die rauchen oder geraucht haben, stieg das Mortalitätsrisiko im Vergleich zu normal gewichtigen Personen die nicht rauchen. Diese Ergebnisse sind vergleichbar mit anderen Studien (1-4). Ein statistisch signifikanter Interaktionseffekt konnte bei der Analyse der meisten Daten nicht gefunden werden. Auch vorherige Studien konnten ein Interaktionseffekt zwischen BMI und Rauchen auf Mortalität nicht bestätigen (3, 5). Um ein Interaktionseffekt finden zu können, muss der Stichprobenumfang entsprechend gross sein (6). Übereinstimmend mit der Prävalenz von adipösen und untergewichtigen Personen im Jahr 1994 in den USA, gab es auch in dieser Studie mehr adipöse als untergewichtige Personen (7, 8). Im Gegensatz zu den untergewichtigen Personen mit einem Umfang von 507 (power=0.17), war der Umfang von 3741 adipösen Personen (Power=0.80) in dieser Studie zureichend um einen möglichen Interaktionseffekt finden zu können. Ein Interaktionseffekt kann durch Dosis-Respons gestört werden (6). Dosis-Respons und Interaktion stellen eine Störvariable zueinander dar. Aussagekräftige Angaben über die Rauchintensität der Teilnehmer sind eine wichtige Voraussetzung um einen Interaktionseffekt finden zu können. Die Angaben über die Rauchintensität in dieser Studie stammen aus Befragungen. Es ist bekannt, dass Personen ihr Rauchverhalten oft unterschätzen, wodurch die Möglichkeit zu einer Missklassifikation nicht aus zu schliessen ist. Aus der Literatur ging hervor, dass adipöse und untergewichtige rauchende Personen mehr rauchen als normalgewichtige rauchende Personen (9).

Die Sterberate war im Follow-up bei den 60 bis 90 Jährigen am höchsten. Von den 5153 Personen die im Zeitraum der Studie gestorben sind, waren 4022 Personen im Alter zwischen 60 und 90 Jahren. Dies entspricht der Erwartung eines natürlichen, physiologischen Prozesses. In der

vorliegenden Studie wurden Teilnehmer ohne Krebs, Herzanfall oder Herzinfarkt in die Sensitivitätsanalysen mit einbezogen. Auf andere chronische Krankheiten oder Multimorbiditäten wurde nicht adjustiert. Da die Wahrscheinlichkeit von Multimorbidität mit fortschreitendem Alter wächst, könnte hier eine Störvariable vorliegen. In dieser Studie lag das Mortalitätsrisiko bei der höchsten Alterskategorie mit Untergewicht höher, als bei den anderen Alterskategorien mit Untergewicht. Krankheiten und einschneidende Erlebnisse können bei älteren Menschen zu Malnutrition führen. Die Folgen einer Malnutrition sind gravierend und stehen mit einem deutlich erhöhten Mortalitätsrisiko in Verbindung (10).

Das erhöhte Mortalitätsrisiko bei den übergewichtigen und adipösen rauchenden Personen könnte bereits bei Studienbeginn durch bestehende chronische Krankheiten oder Multimorbiditäten beeinflusst worden sein (10). Diese beiden Faktoren wurden in dieser Studie nicht erfasst. Als Folge einer Erkrankung oder durch eine Erkrankung selbst, kann eine Reduktion von körperlicher Aktivität vorliegen, was zu einer Gewichtszunahme führt. Dies hätte bei der Baseline-Messung oder in den ersten fünf Jahren nach Studienbeginn durch Ausschluss von mulitmorbiden Personen vermieden werden können.

Stärken dieser Studie sind die grosse Anzahl an Teilnehmern, die valide gemessenen Werte für Grösse und Gewicht und die Einbeziehung möglicher wichtiger Störvariablen. Zusätzlich war die zuverlässige Verknüpfung der Teilnehmer mit dem Todesursachenregister vorhanden. Die Gesamtmortalität als solches ist eindeutig, die Festlegung krankheitsspezifischer Todesursachen ist jedoch problematischer. Mit der International Classification Ninth Revision (ICD-9) und der International Classification Tenth Revision (ICD-10) wurden die krankheitsspezifischen Todesursachen bestimmt. Es könnte zu einer Fehlkodierung gekommen sein, obwohl anzunehmen ist, dass die Kodierung in den USA zuverlässig durchgeführt wurde.

In dieser Studie wurde das Körpergewicht durch BMI-Kategorien erfasst. Der Vorteil des BMI liegt darin begründet, dass er einfach und relativ exakt zu messen ist. Die BMI-Kategorien waren nach den Richtlinien des WHO in NHANES-III wie folgt vorgeben. Untergewicht mit BMI<18.5, Normal Gewicht mit BMI ≥ 18.5 und <25, Übergewicht mit BMI ≥ 25 und <30 und Adipositas mit BMI ≥ 30. Der BMI als Risikomass ist nicht unumstritten und wird in der Literatur oft diskutiert. Ein Punkt der Diskussion liegt darin, dass der BMI nur das Gesamtgewicht misst und nicht die Masse an Fettgewebe. Studien zeigen, dass vor allem der

Fettmasseanteil die Gesundheit beeinflusst (11, 12). Viszerales Fett ist schädlicher als Fettansammlungen an anderen Körperstellen. Im Alter nimmt das Körpergewicht ab, während der Fettanteil im Verhältnis zum Körpergewicht zunimmt (11, 12). Wie bereits im Vorfeld erwähnt, lag in dieser Studie das Mortalitätsrisiko bei untergewichtigen Personen in der Alterskategorie der 60 bis 90 Jährigen höher, als bei den anderen Alterskategorien. Der zunehmende Fettanteil könnte eine Erklärung dafür sein. Die Verfasserin dieser Studie hat den Bauchumfang und das Verhältnis von Bauch- und Hüftumfang in die Sensitivitätsanalysen miteinbezogen. Dadurch konnte zusätzlich viszerales Fett gemessen werden. Jedoch ist diese Messung nicht valide und fehleranfälliger als die Bestimmung des BMI.

Eine Studie mit Cross-Sectional Design hat den Nachteil, dass Veränderungen über einen gewissen Zeitraum nicht erfasst werden können. Es gibt keine Informationen über Gewichtszunahme und Gewichtsabnahme oder über Änderungen im Rauchverhalten zwischen Baseline und Follow-up. Extreme Gewichtszunahme oder Gewichtsabnahme bei untergewichtigen oder übergewichtigen Personen während der Follow-up Periode kann zu Fehlergebnissen geführt haben. Aus diesen Daten konnte nicht herausgefunden werden, wie lange Ex-Raucher vor der Baseline Befragung bereits mit dem Rauchen aufgehört haben. Residual Konfounding könnten hier die Resultate beeinflusst haben. Zur Bestimmung der Gewichtsänderung oder Änderung im Rauchverhalten könnten mehrere Messungen im Abstand von beispielsweise 5 Jahren erfasst werden. Eine dabei verwendete lineare Regression könnte den Verlauf der Änderungen darstellen.

Obwohl einige Resultate dieser Studie in der Forschung bereits etabliert und mehrfach belegt worden sind, können diese nicht einfach auf die Schweizer Bevölkerung übertragen werden. Die Daten dieser Analyse stammen aus den USA, die Befragungen und Untersuchungen haben nur mit amerikanischen Bürgern stattgefunden. Um die Übertragbarkeit dieser Ergebnisse zu überprüfen, ist es unerlässlich solche Studien in der Schweiz durchzuführen. Es bestehen diverse Studien zu Körpergewicht, Rauchen und Mortalität welche in der Schweiz durchgeführt wurden (4, 13-16). Jedoch lag der Fokus in diesen Studien nicht auf dem Einfluss zwischen BMI und Rauchen mit unterschiedlichen Kombinationen in Zusammenhang auf Mortalität. Die Daten dieser schweizerischen Studien stammten hauptsächlich aus der schweizerischen Gesundheitsbefragung (17), der MONICA-Studie und der Swiss National Cohort Study. In der Zukunft wäre es mit diesen Daten möglich, den BMI und das Rauchen mit unterschiedlichen

Kombinationen auf Mortalität bei schweizerischen Teilnehmern zu untersuchen.

Persönliches Fazit

Das persönliche Ziel der Autorin war es, erstmals selbständig eine Publikation zu schreiben und ein statistisches Verfahren mit STATA durchzuführen. Der Zeitaufwand die Literatur zu lesen, zu selektieren und zu interpretieren wurde von der Autorin unterschätzt. Es existiert bereits sehr viel Literatur über Körpergewicht und Rauchen, wodurch es komplex wurde, die für diese Publikation relevanten Informationen heraus zu filtern. Neben Vollzeitbeschäftigung und Familie war ein gut geplantes Zeitmanagement unerlässlich. Ein Projektplan war notwendig, um die erforderlichen Arbeitsschritte einzuhalten. Über das statistische Verfahren in STATA hat die Autorin sehr viel gelernt. Mithilfe von Büchern, Internet und Modulunterlagen konnte die Autorin alle Auswertungen selbständig durchführen. Dadurch waren die Ergebnisse für sie verständlich und konnten einfacher interpretiert werden. Die Autorin wird in Zukunft von dem erworbenen Wissen hinsichtlich BMI, Rauchen und Mortalität sowie den Erfahrungen mit STATA und dem Publikationsprozess profitieren.

B. Public Health Relevanz

Adipositas stellt ein zunehmendes Gesundheitsproblem dar, welches die Weltgesundheitsorganisation als eine "Epidemie" bezeichnet hat (18). Die Prävalenz von Übergewicht und Adipositas hat weltweit in den letzten 15 Jahren zugenommen (19). Die USA sind das Land mit der höchsten Prävalenz an Übergewicht (55 %) und Adipositas (31 %) in der Gesamtbevölkerung (18). Viele Krankheiten, wie koronare Herzerkrankungen, Diabetes Typ II, Hypertonie und einige bösartigen Neubildungen, werden mit einem erhöhten Körpergewicht assoziiert (20, 21). Ein Zusammenhang zwischen BMI und verschiedenen bekannten Risikofaktoren wie Bluthochdruck, Cholesterin und Diabetes wird in der Literatur beschrieben (22). Auch psychologische, soziale und ökonomische Faktoren können einen negativen Einfluss auf das Körpergewicht haben (23). Die Behandlung von Adipositas ist kompliziert, langfristig und wenig erfolgreich. Präventionsprogramme bei Erwachsenen für die Bekämpfung von Adipositas zeigten hinsichtlich der langfristigen Einhaltung eines gesunden Körpergewichtes nur eine minimale Wirkung oder waren unwirksam (24).

Öffentliche Gesundheitsinformationen durch intensive Kampagnen, sozialen Druck und

Rauchverbote haben zu einer erhöhten Sensibilisierung der Öffentlichkeit über die gesundheitlichen Folgen des Rauchens beigetragen. Diese erhöhte Sensibilisierung hat in den letzten vier Jahrzehnten zu einem Rückgang der Prävalenz des Rauchens in den reichen Ländern geführt (5). Die Prävalenz in den USA liegt ungefähr bei 19% (25). Das Rauchen ist Ursache zahlreicher schwerwiegender Erkrankungen und beeinträchtigt die gesundheitsbezogene Lebensqualität. In den USA sterben jährlich 200.000 Personen an den Folgen des Rauchens (26). Rauchen hat grosse negative finanzielle Auswirkungen für die Gesellschaft und das Gesundheitssystem. In den USA beispielsweise, verursachen die negativen gesundheitlichen Folgen des Rauchens eine wirtschaftliche Belastung von rund $ 193.000.000 pro Jahr (27). Die Folgen des Rauchens sind langfristig. Auswirkungen des Tabakkonsumes auf die Sterblichkeit sind über Jahrzehnte immer noch zu sehen. Tabakentwöhnung hingegen ist mit einer erheblichen Verbesserung des Gesundheitszustands verbunden. Aus der Tabakentwöhnung vor dem 40. Lebensjahr resultiert eine Abnahme von 90% des Mortalitätsrisiko (26). Die öffentliche Gesundheit sollte sich daher sowohl auf das verhindern des Rauchbeginns als auch auf die Förderung der Tabakentwöhnung konzentrieren.

"Reach for a Lucky instead of a sweet" hiess früher ein Werbeslogan für Zigaretten. Ganz im Sinne dieses Slogans sind heutzutage viele Menschen immer noch der Meinung, dass sie mit Rauchen ihr Köpergewicht regulieren können. Die mit dem Rauchen verbundenen Gesundheitsrisiken werden damit in Kauf genommen. Rauchende Personen sind in der Regel schlanker als nicht rauchende Personen. Im Durchschnitt haben rauchende Männer 1 Einheit und rauchende Frauen 1,5 Einheiten BMI weniger (28). Tabakentwöhnung wird assoziiert mit einer Gewichtszunahme von ungefähr 1 bis 5,5 Kg (3, 29, 30). Dies könnte ein Grund sein nicht mit dem Rauchen aufzuhören, sowohl für Personen mit geringem Körpergewicht als auch für Personen die übergewichtig oder adipös sind. Um die Gewichtszunahme nach der Tabakentwöhnung zu verhindern, muss ein besseres Verständnis für die Verhaltensbeziehung und für die biologische Beziehung zwischen Rauchen und Ernährungsgewohnheiten geschaffen werden. Wenn Raucher mit dem Rauchen aufhören, kann der Verlust des metabolischen Auftriebes und zunehmender Appetit zu einer erhöhten Kalorienzufuhr führen (25). Wenn die körperliche Aktivität dabei nicht steigt, entsteht eine positive Energiebilanz die zu einer Gewichtszunahme führt. Diese Gewichtszunahme kann wiederum einige der gesundheitlichen Vorteile der Tabakentwöhnung negativ beeinflussen. Studien haben aufgezeigt, dass Personen die

pro Tag überdurchschnittlich viel Rauchen ein allgemein schlechteres Gesundheitsbewusstsein aufweisen. Daher besteht bei diesen Personen eine höhere Wahrscheinlichkeit auf Übergewicht (13, 14). Interventionen für Tabakentwöhnung ohne Gewichtszunahme basieren vor allem auf der Reduktion von Kalorienaufnahme und Steigerung der körperlichen Aktivität. Obwohl diese Massnahmen für Rauchabstinenz und Gewichtskontrolle kurzfristige Wirkung zeigen, fehlt die Evidenz für einen langfristigen Nutzen (31).

Schlussfolgerung

Adipositas und Rauchen verursachen Krankheiten und Mortalität. Daher ist ein wichtiges Ziel der Public Health, die Prävalenz von Rauchen und Adipositas zu reduzieren. Die Daten der NHANES III-Survey liefern demografische, sozioökonomische und gesundheitsbezogene Informationen. Mit diesen Daten konnte in dieser Studie das Mortalitätsrisiko für BMI und Rauchen bestimmt werden. Bei den Teilnehmern mit Untergewicht oder Adipositas zeigte die Datenanalyse unabhängig des Raucherstatus ein erhöhtes Mortalitätsrisiko. Auch wurde ein Zusammenhang zwischen dem Rauchen oder Exrauchen und Mortalität gefunden. Untergewicht oder Adipositas in Kombination mit dem Rauchen oder Exrauchen, zeigte ein besonders hohes Mortalitätsrisiko. Abgesehen von der Nikotinsucht könnte auch der Glaube, dass Rauchen bei der Kontrolle des Körpergewichts unterstützt, ein möglicher Grund für die Fortsetzung des Rauchens sein. Mehr Wissen in der Bevölkerung über das erhöhte Mortalitätsrisiko im Zusammenhang mit Adipositas oder Untergewicht in Kombination mit dem Rauchen könnte Einzelpersonen motivieren, ihr Verhalten zu ändern.

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D. Ergänzende Information

D.1 Auswertungen Cox Proportional Hazard Model nicht adjustiert

D.1.1. All-Cause Mortalität

Hazard Ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.669376	.2188485	3.91	0.000	1.291093	2.158495
2	.924894	.0430171	-1.68	0.093	.8443055	1.013175
3	1.200883	.0666702	3.30	0.001	1.077062	1.338938
smoke						
former smoker	1.328786	.0634428	5.95	0.000	1.210074	1.459145
current smoker	2.172802	.1359837	12.40	0.000	1.92196	2.456382
hssex	.6505614	.0299133	-9.35	0.000	.594493	.7119178
hsageir	1.098506	.0021003	49.14	0.000	1.094397	1.10263
classificationFrequency						
1	.8128376	.0465639	-3.62	0.000	.7265054	.9094288
2	.9128873	.0503431	-1.65	0.098	.819356	1.017095
alci						
2	.8114165	.0480615	-3.53	0.000	.7224742	.9113084
3	.7682203	.0478005	-4.24	0.000	.6800148	.8678671
4	.8409483	.0663032	-2.20	0.028	.7205317	.9814891
educationcat						
1	1.019501	.0662268	0.30	0.766	.8976148	1.157939
2	.7829598	.0593114	-3.23	0.001	.6749228	.9082906
maritalStatus						
1	1.189174	.0562799	3.66	0.000	1.083821	1.304766
2	1.322033	.1212442	3.04	0.002	1.104518	1.582384
race						
2	1.187215	.0544275	3.74	0.000	1.085184	1.298838
3	.9321034	.0596647	-1.10	0.272	.8221939	1.056705
4	.6793456	.0881249	-2.98	0.003	.5268234	.876025

Hazard Ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	1.653634	.3037301	2.74	0.006	1.153678	2.370249
0#former smoker	2.388914	.9391832	2.22	0.027	1.105437	5.162583
0#current smoker	3.49241	.6475799	6.74	0.000	2.428177	5.023081
1#former smoker	1.349911	.1076873	3.76	0.000	1.154508	1.578386
1#current smoker	2.060594	.1776911	8.38	0.000	1.740146	2.440052
2#never smoker	.9009778	.0650131	-1.45	0.148	.7821472	1.037862
2#former smoker	1.222615	.0924223	2.66	0.008	1.05424	1.417881
2#current smoker	2.008808	.1945887	7.20	0.000	1.661417	2.428836
3#never smoker	1.192655	.0948321	2.22	0.027	1.020536	1.393803
3#former smoker	1.511954	.1281547	4.88	0.000	1.280516	1.785222
3#current smoker	2.755663	.3705692	7.54	0.000	2.117154	3.586739
hssex	.6498789	.0299356	-9.36	0.000	.593773	.7112862
hsageir	1.098463	.0020986	49.16	0.000	1.094357	1.102584
classificationFrequency						
1	.8153125	.046683	-3.57	0.000	.7287571	.9121482
2	.9119978	.0502872	-1.67	0.095	.8185696	1.016089
alci						
2	.812657	.0481059	-3.50	0.000	.7236295	.9126376
3	.7693947	.047828	-4.22	0.000	.6811335	.8690929
4	.8425638	.0663094	-2.18	0.030	.7221193	.9830977
educationcat						
1	1.020628	.0666236	0.31	0.754	.898048	1.159939
2	.7829817	.059496	-3.22	0.001	.6746326	.9087322
maritalStatus						
1	1.188406	.0561782	3.65	0.000	1.083239	1.303784
2	1.320284	.1203506	3.05	0.002	1.104258	1.578571
race						
2	1.186887	.0544658	3.73	0.000	1.084789	1.298594
3	.9319113	.0597506	-1.10	0.271	.8218546	1.056706
4	.6779809	.0886539	-2.97	0.003	.524693	.8760514

Interaktion BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.766923	.2595941	3.87	0.000	1.324803	2.356588
2	.8852485	.0675652	-1.60	0.110	.7622442	1.028102
3	1.102001	.1367262	0.78	0.434	.8641024	1.405395
smoke						
former smoker	1.272995	.0985145	3.12	0.002	1.093829	1.481508
current smoker	2.002523	.2449936	5.68	0.000	1.575551	2.545206
hssex	.6503852	.0299205	-9.35	0.000	.5943044	.7117579
hsageir	1.098486	.0021006	49.12	0.000	1.094376	1.102611
classificationFrequency						
1	.8135668	.0466084	-3.60	0.000	.7271523	.9102507
2	.9120538	.0502935	-1.67	0.095	.8186143	1.016159
alci						
2	.8115233	.048104	-3.52	0.000	.722506	.911508
3	.7685205	.0477888	-4.23	0.000	.6803332	.8681389
4	.8420888	.0662557	-2.18	0.029	.7217396	.9825061
educationcat						
1	1.019465	.0663572	0.30	0.767	.8973541	1.158194
2	.7825425	.0593557	-3.23	0.001	.6744349	.9079791
maritalStatus						
1	1.18868	.0563029	3.65	0.000	1.083289	1.304325
2	1.32273	.1210017	3.06	0.002	1.105602	1.582499
race						
2	1.189988	.0543201	3.81	0.000	1.088139	1.301369
3	.9317399	.059735	-1.10	0.270	.8217115	1.056501
4	.6765651	.0881253	-3.00	0.003	.5241186	.8733526
bmiCat2_smoke	1.02316	.0336325	0.70	0.486	.959316	1.091253

D.1.2. Mortalität Kardiovaskulare Krankheiten

Hazard Ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.265533	.4114178	0.72	0.469	.6691653	2.39339
2	.9652572	.0911097	-0.37	0.708	.8022197	1.161429
3	1.374884	.1518405	2.88	0.004	1.107271	1.707176
smoke						
former smoker	1.246402	.1133355	2.42	0.015	1.042924	1.489578
current smoker	2.140775	.2580572	6.31	0.000	1.690273	2.711348
hssex	.5028009	.0481364	-7.18	0.000	.4167728	.6065864
hsageir	1.115688	.0047517	25.70	0.000	1.106413	1.125041
classificationFrequency						
1	.7943384	.0974782	-1.88	0.061	.6245139	1.010343
2	.9950666	.1123199	-0.04	0.965	.7975623	1.24148
alci						
2	.7625661	.097368	-2.12	0.034	.593724	.9794231
3	.657861	.0871327	-3.16	0.002	.5074415	.852869
4	.8474856	.1364297	-1.03	0.304	.6181515	1.161903
educationcat						
1	.8577948	.1050902	-1.25	0.211	.6746737	1.090619
2	.6802172	.1053862	-2.49	0.013	.502067	.9215811
maritalStatus						
1	1.186417	.1168115	1.74	0.083	.9781929	1.438965
2	1.58348	.2868306	2.54	0.011	1.110237	2.258444
race						
2	1.035744	.094995	0.38	0.702	.8653221	1.239731
3	.7693815	.0990251	-2.04	0.042	.5978308	.9901597
4	.5870913	.1566273	-2.00	0.046	.3480182	.9903971

Hazard Ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	1.695196	.717273	1.25	0.212	.7396628	3.885135
0#former smoker	1.381385	.497996	0.90	0.370	.6814459	2.80026
0#current smoker	2.01419	1.252871	1.13	0.260	.5951103	6.817159
1#former smoker	1.281749	.1918155	1.66	0.097	.9558962	1.718681
1#current smoker	1.610632	.306799	2.50	0.012	1.10878	2.339632
2#never smoker	.8734287	.122878	-0.96	0.336	.6629307	1.150765
2#former smoker	1.090186	.1602815	0.59	0.557	.8172339	1.454302
2#current smoker	2.207219	.4121665	4.24	0.000	1.530682	3.182777
3#never smoker	1.222827	.1888811	1.30	0.193	.9033933	1.655209
3#former smoker	1.535993	.2563299	2.57	0.010	1.107462	2.130342
3#current smoker	3.328194	.8011607	5.00	0.000	2.076317	5.334865
hssex	.4999048	.0479795	-7.22	0.000	.4141768	.6033773
hsageir	1.115565	.0047751	25.55	0.000	1.106244	1.124963
classificationFrequency						
1	.8030046	.0989328	-1.78	0.075	.630725	1.022342
2	.9912699	.112014	-0.08	0.938	.7943265	1.237043
alci						
2	.7631779	.0975265	-2.11	0.034	.5940777	.9804114
3	.6612268	.0875395	-3.12	0.002	.5100967	.8571335
4	.8458118	.1359927	-1.04	0.298	.6171702	1.159158
educationcat						
1	.861987	.106358	-1.20	0.229	.6768091	1.09783
2	.6797802	.1060652	-2.47	0.013	.5006653	.9229741
maritalStatus						
1	1.187185	.1169691	1.74	0.082	.9786937	1.440092
2	1.587473	.2872506	2.55	0.011	1.113453	2.263291
race						
2	1.042922	.0953022	0.46	0.646	.8718936	1.247498
3	.7674451	.0990274	-2.05	0.040	.5959431	.9883023
4	.5760871	.1560023	-2.04	0.042	.3388207	.9795043

Interaktion BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.713314	.5798458	1.59	0.112	.882552	3.326086
2	.7635637	.1147669	-1.79	0.073	.5687183	1.025164
3	.8596692	.2190722	-0.59	0.553	.5216773	1.416644
smoke						
former smoker	.980801	.1559928	-0.12	0.903	.7181101	1.339587
current smoker	1.343418	.3650066	1.09	0.277	.7887213	2.288224
hssex	.5018606	.0482492	-7.17	0.000	.4156639	.6059319
hsageir	1.115554	.0047631	25.61	0.000	1.106257	1.12493
classificationFrequency						
1	.7977824	.0979433	-1.84	0.066	.6271562	1.01483
2	.989241	.1118029	-0.10	0.924	.7926722	1.234555
alci						
2	.7623763	.0974842	-2.12	0.034	.5933619	.9795331
3	.6587196	.0871478	-3.16	0.002	.5082529	.8537314
4	.8520552	.1365978	-1.00	0.318	.6222965	1.166643
educationcat						
1	.8585373	.1059158	-1.24	0.216	.674126	1.093395
2	.6793161	.1059157	-2.48	0.013	.5004348	.9221389
maritalStatus						
1	1.184728	.1171772	1.71	0.087	.9759409	1.438182
2	1.597181	.2890752	2.59	0.010	1.12017	2.277323
race						
2	1.049429	.0961547	0.53	0.599	.8769111	1.255886
3	.7678274	.0992768	-2.04	0.041	.5959355	.9892999
4	.5721226	.1548933	-2.06	0.039	.3365298	.9726456
bmiCat2_smoke	1.135686	.0771573	1.87	0.061	.9940872	1.297454

D.1.3. Krebs Mortalität

Hazard Ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.553297	.4521419	1.51	0.130	.8779408	2.748172
2	.9253065	.0967148	-0.74	0.458	.753894	1.135693
3	1.318368	.1532173	2.38	0.017	1.049798	1.655648
smoke						
former smoker	1.825099	.2096264	5.24	0.000	1.457178	2.285915
current smoker	3.305553	.4046116	9.77	0.000	2.600439	4.201859
hssex	.7871615	.0789667	-2.39	0.017	.6466464	.9582103
hsageir	1.081397	.0036761	23.02	0.000	1.074215	1.088626
classificationFrequency						
1	.7787635	.0963328	-2.02	0.043	.6110897	.9924445
2	.742481	.0969263	-2.28	0.023	.5748553	.9589856
alci						
2	.8725221	.1078593	-1.10	0.270	.6847711	1.111751
3	.9093143	.1136908	-0.76	0.447	.7116749	1.16184
4	.8164189	.1375695	-1.20	0.229	.5867764	1.135935
educationcat						
1	1.101055	.1543928	0.69	0.492	.8364562	1.449356
2	.9417485	.1524804	-0.37	0.711	.6856549	1.293494
maritalStatus						
1	.9544538	.1002832	-0.44	0.657	.7768088	1.172724
2	.7433104	.1448013	-1.52	0.128	.5073872	1.088932
race						
2	1.296868	.1127202	2.99	0.003	1.093721	1.537747
3	.8479575	.1115422	-1.25	0.210	.6552355	1.097364
4	.7019723	.1850613	-1.34	0.180	.4186989	1.176896

Hazard Ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	.6714979	.3311564	-0.81	0.419	.2554091	1.76544
0#former smoker	6.040318	4.217478	2.58	0.010	1.537063	23.73711
0#current smoker	5.276937	1.82283	4.82	0.000	2.681194	10.3857
1#former smoker	2.029293	.4015013	3.58	0.000	1.376958	2.990674
1#current smoker	3.504522	.6351434	6.92	0.000	2.45669	4.999279
2#never smoker	.9990925	.1820788	-0.00	0.996	.6989858	1.428049
2#former smoker	1.803924	.3197692	3.33	0.001	1.274445	2.553379
2#current smoker	3.153751	.655655	5.52	0.000	2.098229	4.740256
3#never smoker	1.52059	.3004821	2.12	0.034	1.032275	2.239901
3#former smoker	2.329837	.4498867	4.38	0.000	1.595691	3.401748
3#current smoker	4.799781	1.085633	6.93	0.000	3.080917	7.477609
hssex	.7881217	.0787784	-2.38	0.017	.6478936	.9587004
hsageir	1.081343	.0036878	22.93	0.000	1.074139	1.088596
classificationFrequency						
1	.7817024	.0966092	-1.99	0.046	.6135299	.9959722
2	.7428844	.0971391	-2.27	0.023	.5749246	.9599123
alci						
2	.8762137	.1082112	-1.07	0.285	.6878291	1.116194
3	.912145	.1143552	-0.73	0.463	.7134142	1.166235
4	.8230014	.1389768	-1.15	0.249	.5910874	1.145907
educationcat						
1	1.102118	.1546972	0.69	0.488	.8370319	1.451156
2	.9420446	.1528841	-0.37	0.713	.6853631	1.294858
maritalStatus						
1	.9493581	.098751	-0.50	0.617	.7742533	1.164065
2	.7452361	.1451323	-1.51	0.131	.5087608	1.091627
race						
2	1.281879	.1125721	2.83	0.005	1.079173	1.522661
3	.8479759	.1115708	-1.25	0.210	.6552101	1.097454
4	.7114414	.188512	-1.28	0.199	.4232325	1.195912

Interaktion BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.41502	.4775242	1.03	0.304	.7302799	2.741801
2	.9955887	.1706155	-0.03	0.979	.7115383	1.393034
3	1.517707	.42795	1.48	0.139	.8732862	2.637661
smoke						
former smoker	1.950133	.3145584	4.14	0.000	1.421527	2.675306
current smoker	3.752617	.9460866	5.25	0.000	2.28939	6.151043
hssex	.7876085	.0789126	-2.38	0.017	.6471728	.9585184
hsageir	1.081425	.0036777	23.02	0.000	1.07424	1.088658
classificationFrequency						
1	.7774871	.0962536	-2.03	0.042	.6099671	.9910144
2	.7435562	.0971075	-2.27	0.023	.5756258	.9604778
alci						
2	.8722087	.1077776	-1.11	0.269	.6845912	1.111244
3	.9084009	.1136651	-0.77	0.443	.7108242	1.160895
4	.8147803	.1370939	-1.22	0.223	.5858797	1.133111
educationcat						
1	1.10114	.1542563	0.69	0.492	.8367413	1.449084
2	.9429168	.1526295	-0.36	0.717	.6865628	1.29499
maritalStatus						
1	.9550533	.100222	-0.44	0.661	.7774947	1.173161
2	.7440654	.1449714	-1.52	0.129	.5078718	1.090104
race						
2	1.293041	.1120983	2.96	0.003	1.090972	1.532538
3	.8482563	.1115553	-1.25	0.211	.6555061	1.097684
4	.7051027	.1857498	-1.33	0.185	.4207259	1.181695
bmiCat2_smoke	.9661805	.0633839	-0.52	0.600	.8495978	1.098761

D.2. Cox Proportional Hazard Model Adjustiert für Gender

D.2.1. All-Cause Mortalität

Männer; Hazard Ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.51636	.2764238	2.28	0.022	1.060742	2.167676
2	.8062473	.0520107	-3.34	0.001	.7104761	.9149283
3	1.084129	.0869927	1.01	0.314	.9263366	1.268801
smoke						
former smoker	1.267233	.0873847	3.43	0.001	1.107009	1.450646
current smoker	1.94929	.1737654	7.49	0.000	1.636766	2.321488
hssex	1	(omitted)				
hsageir	1.097034	.0029716	34.19	0.000	1.091224	1.102874
classificationFrequency						
1	.7852818	.0607196	-3.13	0.002	.6748374	.9138017
2	.795713	.0646695	-2.81	0.005	.6785267	.9331381
alci						
2	.7950809	.0674803	-2.70	0.007	.6732204	.9389997
3	.7867834	.0607947	-3.10	0.002	.6761969	.9154554
4	.8226744	.0780758	-2.06	0.040	.6830189	.9908848
educationcat						
1	1.020535	.0881712	0.24	0.814	.8615404	1.208872
2	.7234136	.0751457	-3.12	0.002	.5901381	.8867878
maritalStatus						
1	1.223426	.0878773	2.81	0.005	1.062742	1.408406
2	1.525739	.1832801	3.52	0.000	1.20563	1.93084
race						
2	1.227284	.0771079	3.26	0.001	1.08507	1.388137
3	.9532809	.0800296	-0.57	0.569	.8086311	1.123806
4	.6049465	.115413	-2.63	0.008	.4161968	.8792962

Männer; Hazard Ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	2.315436	1.041264	1.87	0.062	.958995	5.59048
0#former smoker	1.095864	.3497104	0.29	0.774	.5862786	2.048375
0#current smoker	2.711192	.6274682	4.31	0.000	1.722455	4.267493
1#former smoker	1.133178	.1364681	1.04	0.299	.8949141	1.434878
1#current smoker	1.652038	.2176427	3.81	0.000	1.276066	2.138782
2#never smoker	.6652643	.0863095	-3.14	0.002	.5158865	.8578953
2#former smoker	.9393939	.1053592	-0.56	0.577	.7540035	1.170367
2#current smoker	1.467204	.2071145	2.72	0.007	1.112562	1.934891
3#never smoker	.9283701	.1477785	-0.47	0.641	.6795433	1.268309
3#former smoker	1.224075	.157473	1.57	0.116	.9512541	1.575142
3#current smoker	2.047637	.3731558	3.93	0.000	1.432589	2.926741
hsageir	1.097075	.0029549	34.40	0.000	1.091298	1.102882
classificationFrequency						
1	.7854732	.0609082	-3.11	0.002	.6747173	.9144099
2	.7915539	.0642716	-2.88	0.004	.6750889	.9281112
alci						
2	.7981541	.0677878	-2.65	0.008	.6757539	.9427248
3	.7874934	.0607201	-3.10	0.002	.6770333	.9159753
4	.8214787	.0778763	-2.07	0.038	.6821765	.9892269
educationcat						
1	1.024481	.0886426	0.28	0.780	.864667	1.213832
2	.7211229	.0750567	-3.14	0.002	.5880408	.8843233
maritalStatus						
1	1.217885	.0875302	2.74	0.006	1.057854	1.402126
2	1.520293	.1840049	3.46	0.001	1.199215	1.927336
race						
2	1.238401	.0773414	3.42	0.001	1.095716	1.399667
3	.9486657	.0799412	-0.63	0.532	.8042296	1.119042
4	.6014074	.1155369	-2.65	0.008	.4126982	.8764054

Männer; Interaktion BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	2.720742	.6735971	4.04	0.000	1.674687	4.420191
2	.787457	.1114827	-1.69	0.091	.5966386	1.039303
3	.7504935	.1884519	-1.14	0.253	.4587669	1.227727
smoke						
former smoker	1.650142	.215845	3.83	0.000	1.276948	2.132404
current smoker	.8051207	.1738745	-1.00	0.316	.5272568	1.229419
classificationFrequency						
1	.5408188	.0467454	-7.11	0.000	.4565344	.6406635
2	.584345	.053129	-5.91	0.000	.4889588	.6983391
alci						
2	.565944	.0530539	-6.07	0.000	.4709479	.6801019
3	.5578767	.0478417	-6.81	0.000	.47156	.6599932
4	.7875153	.0869125	-2.16	0.030	.6343244	.9777022
educationcat						
1	.470164	.0492224	-7.21	0.000	.3829387	.5772573
2	.2882233	.0352059	-10.18	0.000	.2268555	.366192
maritalStatus						
1	1.841439	.1621339	6.93	0.000	1.549552	2.188309
2	.4130899	.053168	-6.87	0.000	.3209819	.5316289
race						
2	1.03237	.0655883	0.50	0.616	.9114925	1.169277
3	.3748365	.0340944	-10.79	0.000	.3136267	.4479926
4	.4913732	.0890115	-3.92	0.000	.344514	.7008353
bmiCat2_smoke	1.094199	.0629067	1.57	0.117	.9775889	1.224718

Frauen; Hazard ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.439319	.2572384	2.04	0.042	1.013953	2.043131
2	1.407851	.1050314	4.59	0.000	1.216323	1.629536
3	1.265559	.0998753	2.98	0.003	1.084183	1.477277
smoke						
former smoker	1.281794	.0969489	3.28	0.001	1.10518	1.486632
current smoker	.9463112	.0750439	-0.70	0.487	.8100797	1.105453
classificationFrequency						
1	.572691	.0523069	-6.10	0.000	.4788177	.6849684
2	.868621	.0750691	-1.63	0.103	.7332661	1.028961
alci						
2	.4892242	.0435788	-8.03	0.000	.4108469	.5825536
3	.5310947	.0586392	-5.73	0.000	.4277427	.6594188
4	.9617699	.1598058	-0.23	0.815	.6944284	1.332033
educationcat						
1	.5900704	.0647829	-4.80	0.000	.4758229	.7317493
2	.3878608	.0489681	-7.50	0.000	.3028327	.4967627
maritalStatus						
1	2.909178	.1853753	16.76	0.000	2.567599	3.296198
2	.5908835	.0768051	-4.05	0.000	.457986	.7623451
race						
2	.6613004	.0409403	-6.68	0.000	.585731	.7466194
3	.293351	.0269291	-13.36	0.000	.2450436	.3511816
4	.3582683	.0622628	-5.91	0.000	.2548411	.5036715

Frauen; Hazard ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	.8888951	.2435246	-0.43	0.667	.519561	1.520773
0#former smoker	2.172067	1.090977	1.54	0.123	.811532	5.813542
0#current smoker	1.655394	.4013676	2.08	0.038	1.029211	2.662553
1#former smoker	1.20957	.1600337	1.44	0.150	.9332627	1.567682
1#current smoker	.774528	.0986205	-2.01	0.045	.603457	.994095
2#never smoker	1.307164	.1235411	2.83	0.005	1.086117	1.573198
2#former smoker	1.637369	.2084575	3.87	0.000	1.275764	2.101467
2#current smoker	1.324789	.18553	2.01	0.045	1.006774	1.743257
3#never smoker	1.152353	.1165728	1.40	0.161	.9450861	1.405075
3#former smoker	1.520152	.1919438	3.32	0.001	1.186866	1.947029
3#current smoker	1.187574	.1761522	1.16	0.246	.8879607	1.588282
classificationFrequency						
1	.5735274	.0522741	-6.10	0.000	.4796961	.6857128
2	.8665275	.0752468	-1.65	0.099	.7309057	1.027314
alci						
2	.493137	.0439943	-7.92	0.000	.4140226	.5873692
3	.536506	.0591029	-5.65	0.000	.4323123	.6658121
4	.9606259	.1602725	-0.24	0.810	.6926736	1.332232
educationcat						
1	.5884502	.0643487	-4.85	0.000	.4749217	.7291172
2	.3857783	.0485285	-7.57	0.000	.3014773	.4936522
maritalStatus						
1	2.935947	.1876704	16.85	0.000	2.590206	3.327838
2	.5968111	.0775628	-3.97	0.000	.4625997	.7699605
race						
2	.6595778	.041053	-6.69	0.000	.5838247	.7451601
3	.2928353	.0268362	-13.40	0.000	.2446875	.3504573
4	.3590713	.0626158	-5.87	0.000	.2551148	.5053888

Frauen; Interaktion BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.489226	.2891351	2.05	0.040	1.017858	2.178882
2	1.366189	.1416213	3.01	0.003	1.114982	1.673993
3	1.19306	.1928279	1.09	0.275	.8691161	1.637748
smoke						
former smoker	1.241694	.1388999	1.94	0.053	.9972179	1.546106
current smoker	.8913289	.1515444	-0.68	0.499	.6387136	1.243855
classificationFrequency						
1	.5728974	.0523403	-6.10	0.000	.4789665	.6852492
2	.8683703	.0750229	-1.63	0.102	.733095	1.028607
alci						
2	.4888546	.0435731	-8.03	0.000	.4104916	.5821772
3	.5313406	.0586513	-5.73	0.000	.4279646	.6596874
4	.9626302	.1600437	-0.23	0.819	.6949153	1.333482
educationcat						
1	.5890984	.0646497	-4.82	0.000	.4750811	.7304795
2	.3870282	.0488497	-7.52	0.000	.3022029	.495663
maritalStatus						
1	2.908843	.1853831	16.75	0.000	2.567254	3.295884
2	.5895448	.0769079	-4.05	0.000	.456528	.7613182
race						
2	.6622187	.0410353	-6.65	0.000	.5864783	.7477406
3	.2933688	.0269252	-13.36	0.000	.2450676	.35119
4	.3575299	.0622062	-5.91	0.000	.2542159	.5028311
bmiCat2_smoke	1.016965	.0432468	0.40	0.692	.9356337	1.105366

D.2.2. Mortalität Kardiovaskulare Krankheiten

Männer; Hazard Ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.000893	.3046669	0.00	0.998	.551148	1.817636
2	.927322	.119452	-0.59	0.558	.7204046	1.193671
3	1.313402	.2097822	1.71	0.088	.9603532	1.796241
smoke						
former smoker	1.349318	.1758683	2.30	0.022	1.045111	1.742074
current smoker	2.0634	.344114	4.34	0.000	1.488053	2.861201
hsageir	1.110526	.0065232	17.85	0.000	1.097813	1.123386
classificationFrequency						
1	.7909311	.1245228	-1.49	0.136	.5809219	1.076861
2	.8688957	.1400906	-0.87	0.383	.6334618	1.191832
alci						
2	.8100353	.1416431	-1.20	0.228	.5749793	1.141184
3	.6949406	.1110069	-2.28	0.023	.5081254	.9504395
4	.9259426	.1721843	-0.41	0.679	.6431131	1.333155
educationcat						
1	.8062842	.1313018	-1.32	0.186	.5859521	1.109466
2	.601303	.1245911	-2.45	0.014	.4005998	.9025599
maritalStatus						
1	1.384446	.1940724	2.32	0.020	1.051831	1.822242
2	1.922129	.4424013	2.84	0.005	1.224206	3.017938
race						
2	.9758782	.1224639	-0.19	0.846	.7630802	1.248019
3	.7760631	.1345442	-1.46	0.144	.5524794	1.090129
4	.3550849	.1439281	-2.55	0.011	.1604306	.7859177

Männer; Hazard Ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	.5848347	.4786984	-0.66	0.512	.1175602	2.909416
0#former smoker	2.353724	.8503191	2.37	0.018	1.159377	4.778442
0#current smoker	1.072637	.7574402	0.10	0.921	.2687433	4.281226
1#former smoker	1.312423	.2999727	1.19	0.234	.8385064	2.054193
1#current smoker	1.557288	.4160135	1.66	0.097	.9224937	2.628901
2#never smoker	.9126948	.2270496	-0.37	0.713	.5604785	1.486251
2#former smoker	1.055777	.2262053	0.25	0.800	.6937223	1.606789
2#current smoker	1.846806	.498354	2.27	0.023	1.088207	3.134229
3#never smoker	.8818918	.2795685	-0.40	0.692	.4737588	1.641622
3#former smoker	1.619413	.3957573	1.97	0.049	1.003053	2.614516
3#current smoker	3.11891	1.031604	3.44	0.001	1.630955	5.964359
hsageir	1.110316	.0064984	17.88	0.000	1.097651	1.123127
classificationFrequency						
1	.7973376	.1249096	-1.45	0.148	.5865232	1.083925
2	.8633525	.1399047	-0.91	0.365	.6284099	1.186133
alci						
2	.8065644	.1415558	-1.22	0.221	.5717931	1.13773
3	.69232	.1110923	-2.29	0.022	.5054876	.9482073
4	.9201088	.1699369	-0.45	0.652	.6406461	1.321479
educationcat						
1	.8202462	.1357148	-1.20	0.231	.5930591	1.134463
2	.6058297	.1272505	-2.39	0.017	.4013738	.9144333
maritalStatus						
1	1.39355	.1954349	2.37	0.018	1.058619	1.834448
2	1.970818	.4589119	2.91	0.004	1.248612	3.110752
race						
2	.9764889	.1229088	-0.19	0.850	.7629934	1.249723
3	.7726576	.1343184	-1.48	0.138	.5495465	1.08635
4	.343947	.1412565	-2.60	0.009	.1537749	.7693036

Männer; Interaktion BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.628804	.6341277	1.25	0.210	.7593737	3.493673
2	.619877	.1474217	-2.01	0.044	.3889156	.9879972
3	.5912287	.2518452	-1.23	0.217	.256534	1.362593
smoke						
former smoker	.9378369	.2140875	-0.28	0.779	.5995196	1.467071
current smoker	1.004173	.4000383	0.01	0.992	.4599248	2.192451
hsageir	1.11036	.0065059	17.87	0.000	1.097681	1.123186
classificationFrequency						
1	.7942588	.1247281	-1.47	0.142	.583825	1.080542
2	.8595045	.1394159	-0.93	0.351	.6254169	1.181209
alci						
2	.8104779	.1419248	-1.20	0.230	.5750095	1.142372
3	.6933803	.1107877	-2.29	0.022	.5069415	.948386
4	.9214377	.1698575	-0.44	0.657	.6420148	1.322473
educationcat						
1	.8151481	.1329104	-1.25	0.210	.5921585	1.122109
2	.6008927	.125205	-2.44	0.015	.3994148	.9040027
maritalStatus						
1	1.382032	.1941915	2.30	0.021	1.049316	1.820246
2	1.948724	.4517642	2.88	0.004	1.237105	3.069688
race						
2	.9849042	.1235412	-0.12	0.903	.7702229	1.259423
3	.7714211	.1338082	-1.50	0.135	.5490788	1.083798
4	.3434462	.1411847	-2.60	0.009	.1534336	.7687708
bmiCat2_smoke	1.216142	.1242394	1.92	0.055	.9954533	1.485757

Frauen; Hazard Ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.42127	.6222848	0.80	0.422	.6025087	3.352663
2	.985552	.1365152	-0.11	0.916	.751218	1.292984
3	1.447881	.2199908	2.44	0.015	1.07496	1.950173
smoke						
former smoker	1.152623	.1628814	1.01	0.315	.8737604	1.520484
current smoker	2.335496	.4007261	4.94	0.000	1.668473	3.269181
hsageir	1.125116	.0070571	18.79	0.000	1.111368	1.139034
classificationFrequency						
1	.7908853	.1543755	-1.20	0.229	.5394525	1.159508
2	1.162057	.1821572	0.96	0.338	.8546513	1.580032
alci						
2	.7079454	.1351003	-1.81	0.070	.4870238	1.029081
3	.6132018	.1493169	-2.01	0.045	.3804683	.9882991
4	.6616109	.241594	-1.13	0.258	.3234121	1.353471
educationcat						
1	.9892813	.1834781	-0.06	0.954	.6877649	1.422983
2	.8596943	.2029472	-0.64	0.522	.5412376	1.365526
maritalStatus						
1	.9949166	.1310612	-0.04	0.969	.7685099	1.288024
2	1.154141	.3405856	0.49	0.627	.6472219	2.058092
race						
2	1.123321	.1511776	0.86	0.388	.86286	1.462403
3	.7805865	.1455494	-1.33	0.184	.5416189	1.124989
4	1.028708	.3547336	0.08	0.935	.5232973	2.022254

Frauen; Hazard Ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	1.903934	.8923333	1.37	0.169	.7597743	4.771109
0#former smoker	4.63e-20	2.51e-20	-82.29	0.000	1.60e-20	1.34e-19
0#current smoker	2.822469	2.152168	1.36	0.174	.6331879	12.5813
1#former smoker	1.226129	.2752404	0.91	0.364	.7896711	1.903822
1#current smoker	1.652435	.4985531	1.66	0.096	.914729	2.985084
2#never smoker	.8344883	.1417495	-1.07	0.287	.5981662	1.164176
2#former smoker	1.162315	.2845866	0.61	0.539	.7192791	1.878237
2#current smoker	2.842305	.7700184	3.86	0.000	1.671294	4.833797
3#never smoker	1.417869	.2546944	1.94	0.052	.9970631	2.016274
3#former smoker	1.371849	.3447796	1.26	0.208	.838231	2.245169
3#current smoker	3.58838	1.236981	3.71	0.000	1.825801	7.052507
hsageir	1.124736	.0070409	18.78	0.000	1.11102	1.138622
classificationFrequency						
1	.8005457	.1568906	-1.14	0.256	.5452008	1.175481
2	1.163751	.1812453	0.97	0.330	.8575965	1.579201
alci						
2	.7024226	.134825	-1.84	0.066	.4821756	1.023273
3	.6199341	.1492092	-1.99	0.047	.3867761	.9936456
4	.6636911	.2424155	-1.12	0.262	.3243697	1.357975
educationcat						
1	.9803517	.1808911	-0.11	0.914	.6828265	1.407516
2	.8647284	.2045565	-0.61	0.539	.5438877	1.374834
maritalStatus						
1	1.011469	.1331989	0.09	0.931	.7813603	1.309344
2	1.153864	.3383302	0.49	0.625	.6494599	2.050014
race						
2	1.104916	.1498797	0.74	0.462	.8469494	1.441455
3	.7746078	.144903	-1.37	0.172	.5368337	1.117697
4	1.001038	.3529215	0.00	0.998	.5015733	1.997869

Frauen; BMI und Rauchen Interaktion

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.768166	.8041738	1.25	0.210	.7250441	4.31203
2	.8524165	.168159	-0.81	0.418	.5790565	1.254824
3	1.074112	.348923	0.22	0.826	.568224	2.030391
smoke						
former smoker	.9694803	.2345331	-0.13	0.898	.6034	1.55766
current smoker	1.676159	.6595383	1.31	0.189	.7751039	3.624688
hsageir	1.124984	.0070868	18.69	0.000	1.111178	1.138961
classificationFrequency						
1	.7968269	.155615	-1.16	0.245	.5433986	1.168448
2	1.154838	.1806909	0.92	0.358	.8498249	1.569325
alci						
2	.7095425	.1358633	-1.79	0.073	.4875049	1.032709
3	.6168998	.1501394	-1.98	0.047	.3828576	.9940127
4	.6779705	.2471378	-1.07	0.286	.3318214	1.385215
educationcat						
1	.9782909	.1821499	-0.12	0.906	.6791571	1.409178
2	.8547967	.2018373	-0.66	0.506	.538097	1.357891
maritalStatus						
1	.9913572	.1303719	-0.07	0.947	.7660943	1.282856
2	1.160323	.3404547	0.51	0.612	.6528408	2.062292
race						
2	1.13265	.151893	0.93	0.353	.87084	1.473171
3	.778198	.1461643	-1.34	0.182	.5385215	1.124546
4	.9989419	.3512232	-0.00	0.998	.5014657	1.989937
bmiCat2_smoke	1.094521	.1054357	0.94	0.348	.9061956	1.321985

D.2.3 Krebs Mortalität

Männer; Hazard Ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.465818	.5527829	1.01	0.311	.6999331	3.069754
2	.7767664	.1062525	-1.85	0.065	.5940843	1.015624
3	1.116637	.1882026	0.65	0.513	.8024857	1.553771
smoke						
former smoker	1.575299	.2546772	2.81	0.005	1.147468	2.162646
current smoker	2.801147	.5254822	5.49	0.000	1.939293	4.046023
hsageir	1.096213	.0056791	17.73	0.000	1.085137	1.107401
classificationFrequency						
1	.8003802	.1323792	-1.35	0.178	.5787644	1.106855
2	.5186076	.0948912	-3.59	0.000	.3623108	.742329
alci						
2	.8699881	.1544765	-0.78	0.433	.6142741	1.232152
3	.9504154	.1429655	-0.34	0.735	.7077231	1.276332
4	.8573376	.1759349	-0.75	0.453	.5734085	1.281857
educationcat						
1	.9877543	.1891381	-0.06	0.949	.678652	1.437642
2	.6612527	.1490337	-1.84	0.066	.4251183	1.028549
maritalStatus						
1	.993007	.1425521	-0.05	0.961	.7494606	1.315697
2	.8534475	.2371068	-0.57	0.568	.4950827	1.471214
race						
2	1.405036	.1598973	2.99	0.003	1.124117	1.756157
3	.6835754	.1233319	-2.11	0.035	.4799551	.9735814
4	.6446643	.2594404	-1.09	0.275	.2929208	1.418786

Männer; Hazard Ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	.7901431	.6539789	-0.28	0.776	.1560063	4.00193
0#former smoker	.7865488	.6511666	-0.29	0.772	.1552337	3.98534
0#current smoker	6.055868	2.93893	3.71	0.000	2.339147	15.67817
1#former smoker	1.532769	.4598731	1.42	0.155	.8512853	2.759804
1#current smoker	3.074936	.9093165	3.80	0.000	1.722275	5.489967
2#never smoker	.7784607	.2405747	-0.81	0.418	.4247801	1.426623
2#former smoker	1.325499	.364566	1.02	0.306	.7731223	2.272534
2#current smoker	2.119135	.7054667	2.26	0.024	1.103498	4.069544
3#never smoker	1.270068	.5110821	0.59	0.552	.577132	2.794979
3#former smoker	1.843689	.5618219	2.01	0.045	1.014578	3.350346
3#current smoker	2.900585	1.11824	2.76	0.006	1.362404	6.175402
hsageir	1.096345	.0056501	17.85	0.000	1.085326	1.107475
classificationFrequency						
1	.7975799	.131892	-1.37	0.171	.5767736	1.102917
2	.5187203	.0954274	-3.57	0.000	.3616842	.7439385
alci						
2	.8680445	.1538296	-0.80	0.425	.6133196	1.228562
3	.9461033	.1421965	-0.37	0.712	.7046878	1.270224
4	.8537404	.1757407	-0.77	0.442	.5702899	1.278074
educationcat						
1	.9810406	.1874467	-0.10	0.920	.674586	1.426713
2	.662129	.1481442	-1.84	0.065	.4270536	1.026604
maritalStatus						
1	.9868711	.1424223	-0.09	0.927	.7437193	1.309519
2	.8400268	.2342176	-0.63	0.532	.4863439	1.450918
race						
2	1.407063	.1597469	3.01	0.003	1.126337	1.757758
3	.6863109	.1239044	-2.09	0.037	.4817671	.9776978
4	.6528827	.2630393	-1.06	0.290	.2963956	1.438131

Männer; Interaktion BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.100495	.5166639	0.20	0.838	.4384658	2.762106
2	.9865154	.2927508	-0.05	0.964	.5514301	1.764889
3	1.756746	.9195451	1.08	0.282	.6296924	4.901056
smoke						
former smoker	1.933507	.5316732	2.40	0.017	1.127892	3.314546
current smoker	4.127954	1.863761	3.14	0.002	1.7037	10.00176
hsageir	1.096311	.0056601	17.81	0.000	1.085272	1.107461
classificationFrequency						
1	.7985488	.1319104	-1.36	0.173	.5776754	1.103873
2	.5212268	.0951662	-3.57	0.000	.3644204	.7455054
alci						
2	.8688607	.1540159	-0.79	0.428	.6138387	1.229833
3	.9502095	.1431734	-0.34	0.735	.7072211	1.276684
4	.8573937	.1759035	-0.75	0.453	.5735023	1.281815
educationcat						
1	.9791319	.1872319	-0.11	0.912	.6730716	1.424364
2	.6598363	.1482724	-1.85	0.064	.424765	1.024999
maritalStatus						
1	.9939689	.1430965	-0.04	0.966	.7495858	1.318027
2	.8506586	.235986	-0.58	0.560	.4938584	1.465238
race						
2	1.399283	.1592915	2.95	0.003	1.119437	1.749086
3	.6853823	.1236515	-2.09	0.036	.4812324	.9761371
4	.653085	.2609409	-1.07	0.286	.2984336	1.429196
bmiCat2_smoke	.8997737	.1051596	-0.90	0.366	.715556	1.131418

Frauen; Hazard Ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.522693	.572105	1.12	0.263	.729084	3.180146
2	1.170593	.1904316	0.97	0.333	.8509873	1.610232
3	1.590532	.2528105	2.92	0.004	1.164761	2.171939
smoke						
former smoker	1.77508	.2890423	3.52	0.000	1.290043	2.442482
current smoker	3.407623	.536994	7.78	0.000	2.502101	4.640858
hsageir	1.06824	.0049558	14.23	0.000	1.05857	1.077998
classificationFrequency						
1	.7523676	.1380883	-1.55	0.121	.5250385	1.078125
2	1.020739	.1831935	0.11	0.909	.7180226	1.451081
alci						
2	.8430742	.1437613	-1.00	0.317	.6035436	1.177668
3	.9097864	.1886877	-0.46	0.648	.6058847	1.36612
4	.8265779	.241156	-0.65	0.514	.4665806	1.464336
educationcat						
1	1.525516	.3202369	2.01	0.044	1.010927	2.302044
2	1.634426	.3857544	2.08	0.037	1.029087	2.595841
maritalStatus						
1	1.065722	.1526762	0.44	0.657	.8048074	1.411225
2	.7475957	.2080364	-1.05	0.296	.4332947	1.289883
race						
2	1.080844	.147932	0.57	0.570	.8265206	1.413424
3	1.101118	.2023723	0.52	0.600	.7680373	1.578648
4	.7573266	.2594378	-0.81	0.417	.3869605	1.482176

Frauen; Hazard Ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	.6079854	.3468488	-0.87	0.383	.1987279	1.860062
0#former smoker	9.942228	7.316893	3.12	0.002	2.349668	42.06887
0#current smoker	4.289959	1.970823	3.17	0.002	1.743336	10.55663
1#former smoker	2.038986	.5802887	2.50	0.012	1.167209	3.561887
1#current smoker	3.076181	.7423453	4.66	0.000	1.916838	4.936718
2#never smoker	1.14545	.262964	0.59	0.554	.7303818	1.796396
2#former smoker	1.940288	.5244567	2.45	0.014	1.142279	3.295797
2#current smoker	4.379368	1.174215	5.51	0.000	2.589213	7.407216
3#never smoker	1.713898	.3851671	2.40	0.017	1.103265	2.662502
3#former smoker	2.318482	.6289139	3.10	0.002	1.362354	3.94564
3#current smoker	5.950505	1.617088	6.56	0.000	3.493159	10.13653
hsageir	1.068496	.0049885	14.19	0.000	1.058762	1.078319
classificationFrequency						
1	.7594632	.1396644	-1.50	0.135	.5296159	1.089062
2	1.012939	.1816347	0.07	0.943	.712755	1.43955
alci						
2	.8522769	.144805	-0.94	0.347	.6108695	1.189085
3	.9339693	.1951133	-0.33	0.744	.6201516	1.406589
4	.8492581	.2492391	-0.56	0.578	.4777636	1.509616
educationcat						
1	1.528155	.3208701	2.02	0.043	1.012573	2.30626
2	1.627482	.384112	2.06	0.039	1.024719	2.584802
maritalStatus						
1	1.04596	.1488567	0.32	0.752	.7913473	1.382493
2	.7544606	.2099928	-1.01	0.311	.437221	1.301883
race						
2	1.067075	.1466487	0.47	0.637	.8150903	1.39696
3	1.105696	.2033182	0.55	0.585	.7710883	1.585505
4	.7835118	.2704252	-0.71	0.480	.3983248	1.541181

Frauen; Interaktion BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.601006	.6783596	1.11	0.267	.6977614	3.673491
2	1.128077	.2512213	0.54	0.588	.729062	1.745474
3	1.478946	.4953583	1.17	0.243	.7670636	2.851501
smoke						
former smoker	1.712573	.3656684	2.52	0.012	1.126908	2.602616
current smoker	3.180142	.9813388	3.75	0.000	1.736848	5.82279
hsageir	1.068243	.0049523	14.24	0.000	1.05858	1.077995
classificationFrequency						
1	.7534813	.1386729	-1.54	0.124	.5252961	1.080789
2	1.019842	.18332	0.11	0.913	.7169945	1.450607
alci						
2	.8433233	.1437735	-1.00	0.318	.6037644	1.177933
3	.9111524	.1883809	-0.45	0.653	.6075651	1.366436
4	.8290821	.2413052	-0.64	0.520	.4686379	1.466755
educationcat						
1	1.522552	.3204956	2.00	0.046	1.007819	2.300178
2	1.631153	.3862621	2.07	0.039	1.025448	2.594632
maritalStatus						
1	1.065219	.1523879	0.44	0.659	.8047477	1.409998
2	.7463915	.2078432	-1.05	0.294	.4324356	1.288285
race						
2	1.082198	.1476137	0.58	0.563	.8283109	1.413905
3	1.10172	.2023124	0.53	0.598	.7686908	1.579032
4	.7542457	.2595931	-0.82	0.413	.3841756	1.480799
bmiCat2_smoke	1.018621	.0801636	0.23	0.815	.873012	1.188517

D.3. Cox Proprotional Hazard Model Adjustiert für Alter

D.3.1 All-Cause Mortalität

Altersklasse 18-39; Hazard Ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.157167	.5320186	0.32	0.751	.4699167	2.849515
2	1.048816	.2135285	0.23	0.815	.7037065	1.563174
3	1.874682	.3949338	2.98	0.003	1.240496	2.833088
smoke						
former smoker	1.175374	.3325254	0.57	0.568	.6750652	2.046474
current smoker	1.627986	.3244989	2.44	0.014	1.10147	2.406181
hssex	.5859275	.1141513	-2.74	0.006	.3999449	.858396
classificationFrequency						
1	1.012061	.1986825	0.06	0.951	.6887983	1.487037
2	.9914457	.2190914	-0.04	0.969	.6429186	1.52891
alci						
2	1.287266	.2816241	1.15	0.248	.8383633	1.976534
3	1.099861	.246403	0.42	0.671	.7089717	1.706265
4	.9931749	.3411972	-0.02	0.984	.5065033	1.947463
educationcat						
1	1.20533	.3099756	0.73	0.468	.728093	1.995378
2	.734145	.2215256	-1.02	0.306	.4063659	1.326314
maritalStatus						
1	1.686263	.4194251	2.10	0.036	1.035597	2.745741
2	1.105551	.2089555	0.53	0.595	.7632837	1.601297
race						
2	1.595217	.2475179	3.01	0.003	1.176891	2.162238
3	1.041937	.1821285	0.24	0.814	.7396785	1.467709
4	.4806104	.2183878	-1.61	0.107	.1972347	1.171124

Altersklasse 18-39; Hazard Ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	.9963659	.6784927	-0.01	0.996	.2622639	3.78529
0#former smoker	6.81e-15	3.05e-15	-72.74	0.000	2.83e-15	1.64e-14
0#current smoker	2.042488	1.27526	1.14	0.253	.6007058	6.944762
1#former smoker	.8176619	.3675702	-0.45	0.654	.338766	1.973548
1#current smoker	1.536861	.4414588	1.50	0.135	.8752106	2.698712
2#never smoker	.7787339	.2686382	-0.72	0.468	.3960333	1.531251
2#former smoker	1.21466	.5386537	0.44	0.661	.5092774	2.897042
2#current smoker	1.839473	.583553	1.92	0.055	.9877348	3.425678
3#never smoker	1.921166	.6290106	1.99	0.046	1.011238	3.649864
3#former smoker	2.758988	1.374952	2.04	0.042	1.038774	7.32788
3#current smoker	2.290992	.7574903	2.51	0.012	1.198296	4.380089
hssex	.5944156	.1139873	-2.71	0.007	.4081779	.8656271
classificationFrequency						
1	1.009445	.196124	0.05	0.961	.689751	1.477315
2	1.000868	.2210197	0.00	0.997	.6492244	1.542975
alci						
2	1.30163	.2856455	1.20	0.230	.8465969	2.001236
3	1.117431	.2485063	0.50	0.618	.7226179	1.727958
4	.9999551	.3426234	-0.00	1.000	.5108646	1.95729
educationcat						
1	1.182799	.304143	0.65	0.514	.7145285	1.957954
2	.7229912	.2206108	-1.06	0.288	.3975417	1.314871
maritalStatus						
1	1.705011	.4226613	2.15	0.031	1.04883	2.771718
2	1.112534	.2100859	0.56	0.572	.7683608	1.610873
race						
2	1.580478	.2471019	2.93	0.003	1.163315	2.147236
3	1.038299	.1821063	0.21	0.830	.7362424	1.46428
4	.4812139	.2196483	-1.60	0.109	.1966907	1.177315

Altersklasse 18-39; Interaktion BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.049882	.5158816	0.10	0.921	.4007336	2.750584
2	1.159513	.3451363	0.50	0.619	.6469824	2.078061
3	2.271761	1.106368	1.68	0.092	.8745635	5.901112
smoke						
former smoker	1.277866	.4364609	0.72	0.473	.6542348	2.495957
current smoker	1.915251	.7907077	1.57	0.115	.8526774	4.301964
hssex	.5881669	.1141545	-2.73	0.006	.4020532	.8604342
classificationFrequency						
1	1.014262	.198469	0.07	0.942	.6911576	1.488412
2	.9952918	.2179516	-0.02	0.983	.6479467	1.528838
alci						
2	1.289293	.2821092	1.16	0.246	.8396305	1.979772
3	1.10152	.2470296	0.43	0.666	.709719	1.709613
4	.9901356	.340953	-0.03	0.977	.5041543	1.94458
educationcat						
1	1.200861	.3086909	0.71	0.476	.7255541	1.98754
2	.7350991	.2216912	-1.02	0.308	.4070267	1.327605
maritalStatus						
1	1.681303	.4171254	2.09	0.036	1.033835	2.734265
2	1.108932	.209333	0.55	0.584	.7659715	1.605451
race						
2	1.589933	.2468714	2.99	0.003	1.172742	2.155536
3	1.042974	.1822746	0.24	0.810	.7404635	1.469073
4	.4828028	.2196011	-1.60	0.109	.1979599	1.177504
bmiCat2_smoke	.9549321	.095203	-0.46	0.644	.7854259	1.16102

Altersklasse 40-59; Hazard Ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.787572	.5670952	1.83	0.067	.9598583	3.329047
2	.9519871	.1246014	-0.38	0.707	.7365691	1.230407
3	1.756875	.2144166	4.62	0.000	1.383087	2.231682
smoke						
former smoker	1.555141	.2237702	3.07	0.002	1.172955	2.061855
current smoker	2.758171	.3659775	7.65	0.000	2.126517	3.57745
hssex	.6873399	.0773039	-3.33	0.001	.5513557	.8568628
classificationFrequency						
1	.5818113	.0827057	-3.81	0.000	.4403254	.7687597
2	.6820605	.104988	-2.49	0.013	.5044179	.9222641
alci						
2	.6308306	.0861558	-3.37	0.001	.4826717	.8244677
3	.7088152	.1003859	-2.43	0.015	.5369988	.9356053
4	.6905379	.1315829	-1.94	0.052	.4753121	1.00322
educationcat						
1	.839977	.1496557	-0.98	0.328	.5923814	1.191059
2	.5901561	.1193926	-2.61	0.009	.3969642	.8773694
maritalStatus						
1	1.347728	.1590559	2.53	0.011	1.069396	1.698502
2	1.241943	.251247	1.07	0.284	.8353927	1.846346
race						
2	1.239747	.1188105	2.24	0.025	1.027432	1.495936
3	.8707848	.1115527	-1.08	0.280	.6774222	1.119341
4	.8761569	.2252407	-0.51	0.607	.5293485	1.450181

Altersklasse 40-59; Hazard Ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	1.079848	.8993274	0.09	0.927	.2110621	5.524785
0#former smoker	6.771146	4.893579	2.65	0.008	1.642282	27.91751
0#current smoker	4.218146	1.77316	3.42	0.001	1.850469	9.615267
1#former smoker	1.508516	.4526141	1.37	0.171	.8377966	2.716198
1#current smoker	2.677325	.6676341	3.95	0.000	1.642198	4.364921
2#never smoker	1.045098	.2902892	0.16	0.874	.6063298	1.80138
2#former smoker	1.32416	.3723044	1.00	0.318	.7631288	2.297645
2#current smoker	2.548786	.6792147	3.51	0.000	1.511767	4.297163
3#never smoker	1.588523	.4108618	1.79	0.074	.9567981	2.637343
3#former smoker	2.736749	.7110474	3.87	0.000	1.644619	4.554123
3#current smoker	4.838148	1.230561	6.20	0.000	2.938767	7.965137
hssex	.6901641	.0777275	-3.29	0.001	.5534546	.8606424
classificationFrequency						
1	.5856105	.0831562	-3.77	0.000	.4433336	.7735475
2	.674083	.1042647	-2.55	0.011	.497787	.9128158
alci						
2	.6268687	.0851745	-3.44	0.001	.480301	.8181628
3	.6977743	.099875	-2.51	0.012	.5270733	.9237594
4	.698158	.1317638	-1.90	0.057	.4822753	1.010677
educationcat						
1	.8437913	.1500664	-0.96	0.340	.5954433	1.195721
2	.5861655	.1185313	-2.64	0.008	.394351	.8712797
maritalStatus						
1	1.344118	.157914	2.52	0.012	1.067645	1.692185
2	1.203339	.2490299	0.89	0.371	.8020856	1.805325
race						
2	1.250484	.1204022	2.32	0.020	1.035416	1.510223
3	.8732024	.1118677	-1.06	0.290	.6792948	1.122462
4	.8930418	.2291776	-0.44	0.659	.5400282	1.476818

Altersklasse 40-59; Interaktion BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.92659	.6991429	1.81	0.071	.9459635	3.923776
2	.8910704	.1888528	-0.54	0.586	.5881615	1.34998
3	1.549068	.5064822	1.34	0.181	.8160994	2.940342
smoke						
former smoker	1.465143	.3059699	1.83	0.067	.9729914	2.206231
current smoker	2.457015	.768735	2.87	0.004	1.330672	4.536746
hssex	.6864678	.077477	-3.33	0.001	.5502299	.8564385
classificationFrequency						
1	.5827187	.082704	-3.81	0.000	.4412061	.7696201
2	.6820971	.1050091	-2.49	0.013	.5044225	.9223546
alci						
2	.6311908	.0862175	-3.37	0.001	.4829284	.8249707
3	.7091208	.100429	-2.43	0.015	.5372308	.936008
4	.6910278	.1315255	-1.94	0.052	.4758527	1.003502
educationcat						
1	.8380881	.1496251	-0.99	0.322	.5906266	1.189231
2	.5876318	.1187061	-2.63	0.008	.3954981	.8731045
maritalStatus						
1	1.347806	.1590864	2.53	0.011	1.069424	1.698653
2	1.238321	.2514685	1.05	0.293	.8316988	1.843743
race						
2	1.24471	.1197554	2.28	0.023	1.030783	1.503035
3	.871009	.1117678	-1.08	0.282	.6773124	1.120099
4	.8752727	.2250427	-0.52	0.604	.5287796	1.448812
bmiCat2_smoke	1.028422	.0689497	0.42	0.676	.9017775	1.172853

Altersklasse 60-90; Hazard Ratio BMI, Hazard Ratio Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	2.049638	.4325574	3.40	0.001	1.355272	3.099758
2	.8625859	.0478775	-2.66	0.008	.7736659	.9617257
3	.8344011	.0533677	-2.83	0.005	.7360865	.945847
smoke						
former smoker	1.217368	.068121	3.52	0.000	1.090906	1.35849
current smoker	1.416103	.0976401	5.05	0.000	1.237088	1.621022
hssex	.6401365	.0345941	-8.25	0.000	.5757965	.7116659
classificationFrequency						
1	.7391351	.0512989	-4.36	0.000	.6451238	.8468464
2	.9474716	.0596371	-0.86	0.391	.8375003	1.071883
alci						
2	.6993117	.0500674	-5.00	0.000	.6077495	.8046683
3	.6166453	.047552	-6.27	0.000	.5301409	.7172649
4	.8437295	.080697	-1.78	0.076	.6994972	1.017702
educationcat						
1	.8536964	.066789	-2.02	0.043	.732327	.9951805
2	.7053057	.0632724	-3.89	0.000	.5915773	.8408979
maritalStatus						
1	1.57574	.0858728	8.34	0.000	1.416098	1.753377
2	1.011288	.1265967	0.09	0.929	.7912447	1.292524
race						
2	.9198444	.0491499	-1.56	0.118	.828379	1.021409
3	.6058019	.0474701	-6.40	0.000	.5195492	.7063738
4	.5164963	.072223	-4.72	0.000	.392675	.6793618

Altersklasse 60-90; Hazard Ratio BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2#smoke						
0#never smoker	2.086648	.4774806	3.21	0.001	1.332473	3.267685
0#former smoker	1.615737	1.139688	0.68	0.496	.4054333	6.439049
0#current smoker	3.578351	.642494	7.10	0.000	2.516744	5.087764
1#former smoker	1.250073	.1178574	2.37	0.018	1.03915	1.503808
1#current smoker	1.39779	.147295	3.18	0.001	1.136943	1.718483
2#never smoker	.8436309	.0708991	-2.02	0.043	.7155042	.9947015
2#former smoker	1.069684	.0899362	0.80	0.423	.9071599	1.261325
2#current smoker	1.285207	.1381384	2.33	0.020	1.041062	1.586607
3#never smoker	.8836179	.0791889	-1.38	0.167	.7412684	1.053303
3#former smoker	1.007056	.0960762	0.07	0.941	.8352965	1.214133
3#current smoker	1.040662	.1815777	0.23	0.819	.7392297	1.465008
hssex	.6389478	.0347095	-8.25	0.000	.5744106	.7107361
classificationFrequency						
1	.73929	.0512051	-4.36	0.000	.6454378	.846789
2	.9456845	.0595476	-0.89	0.375	.8358809	1.069912
alci						
2	.6973924	.0499128	-5.04	0.000	.6061107	.8024212
3	.6134977	.0471219	-6.36	0.000	.5277508	.7131765
4	.8324237	.0801998	-1.90	0.057	.6891755	1.005447
educationcat						
1	.8568602	.0670873	-1.97	0.049	.7349557	.9989846
2	.706393	.0634583	-3.87	0.000	.592344	.8424007
maritalStatus						
1	1.589153	.0853558	8.62	0.000	1.430353	1.765583
2	.9899165	.1244843	-0.08	0.936	.7736609	1.26662
race						
2	.9157286	.0486666	-1.66	0.098	.8251377	1.016265
3	.6035528	.0475336	-6.41	0.000	.5172175	.7042994
4	.5226129	.0730212	-4.64	0.000	.3974104	.6872599

Altersklasse 60-90; Interaktion BMI und Rauchen

_t	Haz. Ratio	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
bmiCat2						
0	1.878934	.4382557	2.70	0.007	1.189481	2.96801
2	.921137	.0812281	-0.93	0.352	.7749221	1.09494
3	.9488789	.1363827	-0.37	0.715	.7159108	1.257658
smoke						
former smoker	1.304131	.1210054	2.86	0.004	1.087267	1.564251
current smoker	1.60638	.2361477	3.22	0.001	1.204225	2.142835
hssex	.6400366	.0345769	-8.26	0.000	.5757275	.7115291
classificationFrequency						
1	.7379873	.0512141	-4.38	0.000	.6441308	.8455198
2	.9493901	.0597269	-0.83	0.409	.8392498	1.073985
alci						
2	.6977801	.049986	-5.02	0.000	.6063702	.8029699
3	.6158596	.0475093	-6.28	0.000	.5294353	.7163917
4	.8421465	.0806097	-1.79	0.073	.6980807	1.015944
educationcat						
1	.8537612	.0668778	-2.02	0.044	.7322418	.9954475
2	.7052743	.0633262	-3.89	0.000	.5914579	.8409927
maritalStatus						
1	1.576783	.0858196	8.37	0.000	1.41723	1.754298
2	1.007445	.1263108	0.06	0.953	.7879392	1.288102
race						
2	.9164787	.048945	-1.63	0.102	.8253923	1.017617
3	.604519	.0474545	-6.41	0.000	.5183062	.7050721
4	.521192	.0725975	-4.68	0.000	.3966658	.6848111
bmiCat2_smoke	.9632538	.0378398	-0.95	0.341	.8918677	1.040354

D.4 Submitting to the American Journal of Public Health

American Journal of Public Health

The combination of underweight or obesity with current smoking is related to an especially high mortality risk of all causes, CVD and cancer

--Manuscript Draft--

Manuscript Number:	
Article Type:	Research Article
Keywords:	obesity; smoking; mortality
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Abstract:	Background Obesity, underweight and smoking are associated with an increased risk of death. We investigated the joint effects of body mass index and smoking on all-cause and cause-specific mortality. Methods Data of the National Health and Nutrition Examination Survey (1988-1994) including mortality follow-up until 2011, were used. Cox proportional hazard models were used to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for all-cause, cardiovascular disease (CVD) and cancer mortality with BMI, smoking and their combinations as exposure. Results Obese and underweight current smokers were the two combinations with the highest risks of death from all-causes, CVD, and cancer. Among underweight current smokers, the HR of death from all causes was 3.49 (95% CI, 2.42-5.02) and for obese current smokers 2.76 (2.12-3.58). CVD mortality risk was the highest among obese current smokers and for cancer mortality among underweight current smokers. Conclusion Being underweight or obese and smoker at the same time is associated with an especially high risk of death. Smokers with high or low BMI should be particularly targeted for smoking cessation programs.
Full Title:	The combination of underweight or obesity with current smoking is related to an especially high mortality risk of all causes, CVD and cancer
Manuscript Classifications:	17: Epidemiology; 53: Obesity/Overweight/Underweight; 70: Tobacco
Author Comments:	
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Additional Information:	
Question	**Response**
Theme Issue Question	None
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Human Participant Protection statement	We used publically availble data that have been ananymized by NHANES

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Zürich, September 6th, 2016

Dear Dr. Morabia,

Please find enclosed our manuscript **"The combination of underweight or obesity with current smoking is related to an especially high mortality risk of all causes, CVD and cancer"**, which we submit to the American Journal of Public Health for publication consideration.

Studies looking at the joint association between BMI and smoking on mortality are rare and their results are inconsistent. Therefore, the aim of this present study was to assess the association between different BMI categories, smoking status, and their combinations with the risk of all-cause and cause-specific mortality of cancer and cardiovascular disease in National Health and Nutrition Examination Survey (NHANES III) participants.

The increased health risks when smoking is combined with obesity or underweight may not be widely understood. Societies should be encouraged to set up programs, particularly for smokers with high or low BMI. Knowledge in the general population about the higher risk of mortality linked to obesity or underweight and smoking may motivate individuals to modify their behaviour.

We believe that the results of our study are of interest for the readers your journal.

We look forward to hearing from you.

Sincerely,

S. Rohrmann

Sabine Rohrmann
Head, Cancer Registry Zurich and Zug

E. Selbständigkeitserklärung

Hiermit bestätige ich, dass ich die gesamte Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt habe. Alle Stellen der Arbeit, die wörtlich oder sinngemäss aus Quellen entnommen wurden, habe ich als solche kenntlich gemacht.

Ort, Datum Unterschrift

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2009 - heute	Dozentin & Wissenschaftliche Mitarbeiterin Berner Fachhochschule BFH, Bachelorstudiengang Physiotherapie *Verantwortlich für Prüfungen, statistische Auswertungen, Betreuung Bachelorthesen, Gutachterin Masterthesen*
2007 – 2009	Medizinische Trainingstherapie, Rückencenter Zürich *Arbeit als Physiotherapeutin und Trainingsberaterin*
2006 – 2007	Wissenschaftliche Assistentin Gesundheitswissenschaften Universität Maastricht, Faculty of Health Science *Forschungsprojekt: Fear of movement by low back pain*
1998 - 2006	Praxisinhaberin in Heerlen Physiotherapie, Heilgymnastik, Übungstherapie und Ergotherapie, Niederlande (BIG registriert)
1997 - 1998	Therapeutin bei Paramedische Groep Kerkrade Oost, Niederlande
1995 - 1997	Therapeutin bei Paramedisch Opleidingsinstituut voor Oefentherapie en Physiotherapie Tilburg, Niederlande

Aus- und Weiterbildung

2013- Sept. 2016	Master of Public Health der Universitäten Basel, Bern und Zürich, MPH
2010	Fachkurs Statistik der Berner Fachhochschule BFH
2003 – 2007	Master in Health Science an der Universität Maastricht, Niederlande
1992 – 1995	Bachelor in Bewegungstherapie an der Hochschule Amsterdam, Niederlande
1991 - 1992	Studium zur Dolmetscherin in den Sprachen Deutsch, Englisch und Spanisch an der Hochschule für Dolmetscher und Übersetzer, Brüssel, Belgien
1984 - 1991	Obligatorische Grundschulbildung am Newman College Breda, Niederlande

G. Zeitaufwand

2015/2016	Okt	Nov	Dez	Jan	Feb	März	April	Mai	Juni	Juli	Aug/Sept	
Kontakt Betreuerin			2		2	2		2	4	4	4	20
Poweranalyse	3	3										6
Literatursuche	10	10	10			2		2	2	2		38
Literatur Lesen		30	15				2	2	2	1		52
Daten Aufbereitung NHANES III	10											10
Daten NHANES III erheben im STATA		10										10
Selbst- Studie Datenanalysen in STATA			5	5								10
Selbst- Studie Cox Proportional Hazard/STATA				20	5							25
Auswerten/ Analyse deskriptive Daten					30	10						40
Auswerten/Analyse Daten Cox proportional Hazard/ Sensitivitätsanalysen						20	20	10		5		55
Verfassen Manuskript						8	20	25	10	5	5	73
Verfassen Kritische Würdigung									15	5	5	25
Verfassen Public health Relevanz									10	10	1	21
Endbearbeitung Master Thesis/ Einreichen Journal											25	25
Gesamter Zeitaufwand	23	53	32	25	37	42	42	41	43	32	40	**410**